UCL ENERGY INSTITUTE

THE KfW EXPERIENCE IN THE REDUCTION OF ENERGY USE IN AND CO_2 EMISSIONS FROM BUILDINGS: OPERATION, IMPACTS AND LESSONS FOR THE UK

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The full *Cutting Carbon* Costs report may be viewed at:
http://www.brookings.edu/~/media/Files/rc/papers/2011/0902_germany_energy_power_zulauf/0902_energy_power_zulauf.pdf

The summary report may be viewed at:
http://www.brookings.edu/~/media/Files/rc/papers/2011/0317_germany_energy_power_zulauf/0317_germany_energy_power_zulauf.pdf

Glossary

Definitions of essential terms (with German term in brackets as appropriate)

BauGB	German Federal Building Code (Baugesetzbuch)
Biogenic	A substance deriving directly from life processes (also called biomolecules)
bn	billion
Building Envelope	The whole outer shell of a building including roofs, walls, foundation floors, outside windows, doors, extensions.
Bundesamt für Energieeffizienz	BfEE, Federal Office for Energy Efficiency
Bundesländer	see Länder
Bundesrat	Upper house of the German parliament
Bundestag	Lower house of the German parliament
Carbon sinks	Parts of the natural environment that reabsorb carbon e.g. soil, trees, woodland, peat etc
CDU	Christian Democrats (Christlich Demokratische Union)
City State	The city governments of Hamburg, Bremen and Berlin. These city governments are also regional governments or Länder. All other German cities have separate city and regional level governments.
Commune	A German Local Authority (Kommune)
Crowding-out effect	Any reduction in for example consumption or investment due to an increase in government spending
DIN	German Institute for Standardization (Deutsches Institut für Normung e.V.)
DM	Deutschmark, the German currency before the Euro (€) was introduced in 1999
Embodied energy	The energy used to produce materials, transport them and turn them into buildings, appliances or elements of building structures.
EnEG	Energy Conservation Act (Energieeinsparungsgesetz)
Energy	The definition of energy used in this report is close to but not identical with the physical definition. It is important to distinguish different sub-categories of energy in order to provide more clarity when comparing and evaluating the energetic quality of plants and technical and regulatory systems. The three most relevant forms of energy are primary energy (Primärenergie), delivered energy (Bezugsenergie, Endenergie)

	and useful energy (Nutzenergie). Primary energy refers to the energy content of fossil fuels close to the point of extraction from the coal mine or the wellhead and upstream of any significant conversion process. Delivered energy is the amount of energy supplied to the final user (e.g. at the meter) and is sometimes also referred to as final energy. Useful energy is the amount of energy required to carry out a certain task. In the case of electricity, 1 unit of delivered energy requires by convention 2.7 units primary energy to account for losses in the supply chain and the conversion in a plant. Electricity is therefore especially energy intense unless it is gained from renewable sources. In case of a gas boiler, for example, not every kWh of delivered energy (at the meter) is converted into useful heat in the dwelling. Whereas EnEV's predecessor, WSchVO, was framed in terms of useful energy at the room level, today's legislation also accounts for conversion from primary energy, through delivered or final energy, to useful energy. Any benchmark calculated according to EnEV therefore accounts for primary energy demand and includes space heating, hot water, ventilation/infiltration and auxiliary energy (i.e. fans or pumps). Unlike the Passive House standard EnEV doesn't include electrical household appliances like dishwashers, TVs or kettles.
EnEV	Building Energy Conservation Ordinance, BECO (Energieeinsparverordnung) sometimes referred to as Energy Saving Ordinance
Euro (€)	The official currency of the Eurozone used by 17 of the 27 Member States of the EU including Germany, France, Spain and Italy. It is not used in the UK, Sweden, Denmark and several newer member states from Eastern Europe. The exchange rate of August 24th 2011 is £ 1 = €1.14 = $ 1.65.
Feed-in Tariff	The method of payment, now copied in the UK, to households and other organisations for generating electricity from renewable energy sources, either for their own use or to feed into the grid.
GHGs	Greenhouse gases of which Carbon Dioxide (CO_2) is the most significant. Other GHGs include methane (from landfill sites and intensive annual farming) which is far more potent per molecule, but present in the atmosphere at a much lower concentration.
KfW	Reconstruction Loan Company (Kreditanstalt für Wiederaufbau), a publicly owned bank in German and the main subject of this report
KMU	Small and Medium Size Enterprises, SME (Kleine und mittelständige Unternehmen)

kWh (kWh/m^2a)	Kilowatt-hour, a unit of energy (kWh per square metre per year)
KfW-Efficiency House (KfW-Effizienzhaus)	A label created collaboratively by KfW, the German Energy Agency (DENA), and the Federal Ministry of Transport, Building and Urban Development. House standards comprise a set of standards for both new and existing buildings, the most exacting of which qualify for the highest levels of KfW support. The government's current legislative standard for new buildings (today EnEV 2009, from 2012 EnEV 2012) is set 100 (=NL), i.e. KfW-Efficiency House 100. New buildings qualify for support providing they are at least 30% better than the government's standard for new builds. i.e. KfW-Efficiency House 70. At their highest levels KfW-Efficiency Houses are close to the Passive House standard. Other categories for new-builds are KfW-Efficiency House 55 (EnEV – 45%) and 40 (EnEV – 60%). Refurbishment categories are KfW-Efficiency House 115, 100, 85, 70, 55. Note: under EnEV refurbishments must comply with EnEV new-build standard 140, i.e. 40% higher than new-build requirements.
Länder or Bundesländer	Federal States based on German regions which elect their own powerful regional governments and have significant devolved powers.
m	million
Market incentives	Ways of stimulating demand for particular products or activities through financial inducement in the shape of subsidies, favourable loans, grants and tax concessions.
MBO	Model Building Regulation (Musterbauverordnung)
Micro-generation	The term applied to home production, or small scale community level production of energy, normally applied to renewable energy from individual solar, biomass or other small scale generation.
ModEng	Refurbishment and Energy Conservation Act (Modernisierungs- und Energieeinsparungsgesetz, or Gesetz zur Förderung der Modernisierung von Wohnungen und von Maßnahmen zur Einsparung von Heizenergie)
One-two family houses	Individual stand-alone houses split into two units. German subsidies for new-build owner occupation have favoured this form of individual house building.
Passive house (Passivhaus)	This term originates in the German/ Austrian aim of building new homes requiring very little energy to run so that passive heat gains, i.e. from solar radiation and from heat emissions from appliances and occupants are enough to keep the building at design indoor temperatures (e.g. living room ~20°C) throughout the heating period (Note: heating systems in Germany and Austria are designed for considerably lower temperatures (e.g.

	Munich -16°C) than in England and Wales (roughly -5°C). Passive Houses require a specific heat input of less than 10 W/m^2 compared to new-builds 25-40 W/m^2, dwellings from 1995 50-70W/m^2 and dwellings until the 1970's 120-180 W/m^2. The current German new build standard of useful energy for space heating is 100 kWh/(m^2a). The Passive House standard for space heating is a maximum of 15 kWh/(m^2a). Another requirement for Passive Houses is the combined primary energy consumption for space heating, hot water, and household electricity which must not exceed 120 kWh/(m^2a). The British Code for Sustainable Homes awards the highest code level 6 at a standard close to this. The aim to make all new UK homes 'zero carbon' by 2016 is also linked to this aim.
Plattenbauten	Medium-rise apartment buildings built of concrete panels in East Germany in the 1960s.
Retrofit	This means to remodel, adapt, modernise existing buildings, to bring them up to current standards, including with respect to energy efficiency.
Tonnes of CO_2 equivalent (tCO_2e; $MtCO_2e$ is a million tonnes)	A measure used to compare the emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential (GWP) for methane over 100 years is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of carbon dioxide, averaged over 100 years. Note that in the case of methane, over shorter periods, the GWP is greater still.
U-value	The measure of how efficient a building element is at keeping in heat .
VAT	Value-added tax, an EU-wide tax on most goods and services, collected by national governments as an important part of their revenue-raising taxes. There are variable overall levels. In the UK it is currently set at 20%, in Germany at 19%. There are discretionary reductions for energy saving, some kinds of building refurbishment etc.
Whole House approach	An approach to energy saving, common in Germany and increasingly advocated by the UK government, meaning that energy saving measures are proposed and adopted (with some subsidy) covering all major elements of the building envelope and energy system e.g. heating.
Watt (w)	A unit of power
WoModG	Housing Refurbishment Act (Wohnungsmodernisierungsgesetz)
WSchVO	Thermal Insulation Ordinance (Wärmeschutzverordnung)

Executive Summary

The widespread devastation of the German housing stock at the end of the Second World War resulted in the creation, as part of the Marshall Plan, of a remarkable bank: the Kreditanstalt für Wiederaufbau (KfW). The bank proved a most effective vehicle for lending, recovering and re-lending Marshall Plan funds for the reconstruction of German infrastructure and buildings. In subsequent decades the bank expanded and diversified its activities. In the 1970s, in response to the oil price rises, the first German legislation on energy efficiency was passed and KfW started its first lending programmes in this area, offering reduced interest rates for investments in energy efficiency improvements. These continued through the 1980s, but in the 1990s the major emphasis in KfW building programmes was on the refurbishment of the housing stock in the former German Democratic Republic (GDR), following reunification – half the housing stock of the GDR, or 3.6 million dwellings, was refurbished over 10 years.

The 1990s also saw KfW's first programmes devised explicitly in support of climate policy, and it is these programmes that are the major focus of this paper, with a view to exploring how other countries, and particularly the UK, can learn from what KfW has achieved. The achievements are impressive. As of 2010, KfW had financed in total the rehabilitation to high energy efficiency standards of 9 million pre-1979 housing units. Between 2006 and 2009 KfW programmes retrofitted 1 million existing homes with energy-efficient products, and approximately 400,000 highly energy-efficient new homes were built, directly generating approximately a quarter of a million jobs per year, largely in the construction and supply chain. Energy efficiency in new buildings has doubled over 2002 - 2009, reducing calculated energy use from 120 kWh/(m^2a) to 60 kWh/(m^2a), while renovation has reduced it to approximately 80 kWh/(m^2a) in existing buildings. It is estimated that every €1 of subsidy has leveraged €9 in loans and private investment, with a leverage ratio of 1:10 for the KfW programmes and 1:12.5 for the Market Incentive Programme (MAP). Moreover, KfW energy-saving programmes from 2006-2009 have saved heating costs of €1 billion per year, resulting in reduced carbon dioxide (CO_2) emissions of almost 4 $MtCO_2$/year. CO_2 savings through the support programmes (low-interest loans and investment subsidies through KfW and MAP) are estimated at around 1.2 $MtCO_2$ per year. Over the lifetime of the investments, the various measures are estimated to have led to long-term savings of around 72 $MtCO_2$.

The UK has a number of new policy initiatives related to the improvement of home energy efficiency, including the Green Deal, Energy Company Obligation (ECO) and, less directly, the Green Investment Bank. While the particular history and experiences of KfW mean that its approaches to home energy efficiency could not be transferred directly to the UK, nevertheless a comparison between conditions in the two countries shows that there are a number of important lessons from the activities of KfW that are relevant to what the UK is hoping to achieve.

First, the German 'three-pillar' approach of integrating energy efficiency provisions into a clear framework of regulation, information and support for renewables has served it well, creating a strong, enforceable legal standard to underpin change and generating a clear, consistent message about the direction and required radical nature of change.

Second, KfW provides repayable loans on favourable terms, or performance-linked investment subsidies, rather than unconditional subsidies or tax concessions, as a more reliable and sustainable funding mechanism. The UK too is moving towards loans, but without subsidised interest rates and, at present, no provisions for subsidies for more expensive energy efficiency measures. This may not deliver adequate take up of these measures to achieve the large energy efficiency improvements that are required.

Third, the German schemes provide qualified expert advice and installation so that appropriate work is carried out to a high standard. As a result, the promised energy gains and a positive customer experience have been achieved, and over time the German construction industry has acquired great expertise in this area. The UK has much still to prove in this respect, through the accreditation mechanism for energy advisers and energy efficiency installers that is being set up under the Green Deal.

Fourth, German policy requires investments in energy efficiency to be made *before* subsidies for renewable energy are paid. This increases the proportionate contribution renewable energy can make to meeting overall demand, saves money, makes a bigger contribution to the wider goal of climate protection, and provides a more coherent overall message to the public about the need to reduce CO_2 emissions. The UK has yet to adopt this integrated approach[1].

Fifth, German policy assumes it is better to adopt a 'whole house approach' to energy saving, even if measures are adopted piecemeal, and high energy efficiency measures only implemented bit by bit as people work on different parts of their houses. This enables the overall ambition for energy efficiency improvement to become clear for energy suppliers and builders, while giving some assurance to government that the required emission reductions will be achieved.

Sixth, policy aims to support experimentation and innovation, to build awareness and familiarity for new approaches to energy efficiency, and to identify successful approaches that can be taken to scale.

Seventh, public buildings have an important role to play, to provide conspicuous examples to the public of what can be achieved by ambitious retrofit measures. This is

[1] On October 27 2011 in a speech at a Solar Power UK event in Birmingham, Energy Minister Greg Barker was quoted as saying: "So, I can announce today that we will be bringing forward proposals to ensure that all new domestic PV sites from April 2012 must meet minimum energy efficiency standards.", so that this deficiency in UK Government policy seems likely to be speedily rectified (Click Green 2011).

particularly the case in schools, nurseries and children's centres, where such measures can have important educational benefits as well.

Ultimately, conserving attitudes and behaviour towards energy use, and awareness of the need to reduce greenhouse gas emissions, are going to be required if the necessary step changes in home energy efficiency are to be achieved. In this respect the German public is significantly ahead of the UK. There has so far been widespread public support in Germany of the government's energy saving and green initiatives. This is at least partly because of a perception in Germany that energy saving and climate policy can create energy security and economic benefits for the future. The UK has tried to project similar messages, but so far with less intensity, consistency and supporting policy, and less success.

The Green Deal, Energy Company Obligation (ECO) and the Green Investment Bank are all welcome new policies in the right direction. But on the basis of the KfW experience, they do not go far enough on any of the key dimensions: the regulatory framework, the level of the financial incentive or the clarity of the message about integrating home energy efficiency and micro-generation using renewables for both electricity and heat. More will need to be done. In considering this, much can be learnt from what the KfW bank has achieved, how it has achieved it, and the overall policy framework that has supported these achievements.

I Purpose of this Report

Following the recommendations in the Fourth Carbon Budget Report of the Committee on Climate Change (CCC, 2010), the UK Government now has a statutory greenhouse gas (GHG) emissions reduction target for 2025 of a 50% reduction below the level in 1990, building on the 34% reduction already legislated for 2020 and on the way towards an indicative target for 2030 of a 60% reduction, in order to be on track to reach the statutory 80% reduction target by 2050.

Out of total UK GHG emissions in 2008 of 628 $MtCO_2e$, emissions from the residential sector in 2008 accounted for 23% (CCC, 2010) (144 $MtCO_2$), of which 56% are non-electricity related and are mainly due to the provision of heat. Residential emissions have fallen since 1990 for three reasons: over 1990 - 1998 they fell 6%, largely due to the decarbonisation of electricity generation by the switch from coal to gas-fired generation; over 2004 - 2008 they fell by 5%, mainly due to rising fuel prices and government energy efficiency programmes; in 2009 they fell by 5%, mainly due to continuing fuel price increases and the recession.

The emission reduction targets for 2020, 2025 and 2030 are most unlikely to be met without substantial further reductions from the residential sector. CCC analysis (CCC, 2010) estimates that policies need to deliver reductions of 37 $MtCO_2$ (26% of 2008 residential emissions) by 2020, 17 $MtCO_2$ of which would be delivered by ensuring that by then 90% of all lofts and cavity walls are insulated, 2 million (25%) solid walls are insulated, 13 million boilers are replaced with efficient boilers, and substantial increases in appliance efficiency have been achieved.

Post-2020 the CCC calculates an emission reduction potential from further energy efficiency measures in the building fabric of 21 $MtCO_2$. Efficiency gains in appliances could lead to electricity savings of 10TWh, though the carbon emissions reductions from this will depend on the carbon intensity of electricity by that date.

Securing the take up and financing by householders, landlords and housing organisations of this level of efficiency measures represents a significant policy challenge. In the Energy Act 2011 the UK Government has made provision for two significant new policy initiatives, called the Green Deal and the Energy Company Obligation (ECO). It is also in the process of setting up a Green Investment Bank. These policy initiatives will be discussed at the end of this report.

The challenge of increasing the efficiency of the use of energy by the residential sector, in order to reduce CO_2 emissions from the sector, is not by any means confined to the UK, but is faced to some degree by all countries seeking to reduce these emissions. In countries with similar climates and building infrastructures to the UK, it may well be possible to learn from emission reduction experiences, both successful and unsuccessful, in those countries. This report seeks to contribute to such learning.

The KfW Bank in Germany has been lending large sums of money to improve the energy efficiency of residential buildings for many years. This report describes KfW's experiences in this field, how they developed to their current level, the approaches that they take, the successes they have achieved and the challenges they have faced. The purpose of doing so is quite simply to assess to what extent this experience may be relevant to the UK and its new policy initiatives in this area. This assessment is in the final section (VII) of this report, following the description of KfW's work in this field, and the broader German climate change policy context within which it sits, in sections II-VI.

II Introduction to KfW

In the midst of the worst economic downturn in decades, "Kreditanstalt für Wiederaufbau (KfW)" in the year 2009 provided €50.9 billion for industry, the environment, housing and education in Germany, the highest volume of socially directed financing in its history.

Besides supporting small and medium-size enterprises as well as fighting the consequences of the recession, one of KfW's main areas of investment is climate and environmental protection. A significant contribution to the Federal Government's climate protection goals was achieved through KfW's programmes on energy-efficient construction and refurbishment. Here, KfW promoted the improvement of the energy performance of residential buildings and the reduction of CO_2 emissions, by providing a total of €8.9 billion. Furthermore, in 2009 loan commitments to finance commercial investments in energy and environmental protection of about €7 billion were made. "(...) In total, KfW committed €19.8 billion for investments in climate and environmental protection in Germany and abroad. This was nearly one third of KfW Bankengruppe's overall promotional business volume (...) which increased by a third on the year 2008" (KfW, 2010a).

As a result of KfW's actions, German carbon emissions from the existing building stock are thought to have been reduced over the period from 1990 to 2006 by 24%, largely achieved through KfW's programme for the renovation of existing buildings (Kleemann and Richter, 2008). In the year 2006, the average reduction in CO_2 emissions achieved by residential buildings funded under KfW's "CO_2 Building Rehabilitation Programme" is estimated to have been 59% (Clausnitzer et al., 2007). If this programme, which is only one out of a multifaceted portfolio, continued at the same level until 2020, it would deliver nearly half of the saving as laid out in Germany's Integrated Energy and Climate Programme which aims to deliver 40% CO_2 reduction of 1990 levels by 2020. The German subsidy programme for existing buildings is considered "a big success" (IEA, 2007) and one of the few examples in Europe, where "long term financial [policy] efforts (...) had considerable impacts in terms of energy savings and CO_2 emissions reductions" (Boonekamp and Eichhammer, 2007).

The KfW programmes in the area of energy-efficient construction and refurbishment alone created or secured 210,000 jobs in 2008. The learning effect from carrying out energy-efficient refurbishment on a large national scale has also led to a cost reduction for the refurbishment. In the years 2006 and 2007, €360m were saved as a result of this. Taking into account stronger investment demand, reduced imports, increased exports of energy-efficiency knowledge or technology, reduced fuel consumption, and additional tax revenue, these KfW programmes realised a net national benefit of €222 – 444 in 2007 (KfW, 2009c).

As stated in section I, this report seeks to give detailed insights into how KfW achieved these results and their possible relevance to the UK, by explaining the set up and structure of KfW, how KfW successfully encourages low-carbon infrastructure investments in Germany, and how these investments are financed and procured. The report will make recommendations as to what lessons the UK can learn from the KfW approach.

Section III focuses on KfW's evolution and development, in particular how and under what circumstances KfW transitioned from a handful of staff with equity of DM 1m in 1948 to a "heavyweight" in the international capital markets with a refinancing volume of around €75bn. Throughout the years KfW has taken on a variety of challenges, e.g. the reconstruction of 90% of residential buildings after World War II (WWII), or the refurbishment of almost half the residential stock of the former German Democratic Republic between the years 1990 to 1997.

Section IV goes into more detail about the context of German climate policy within which KfW operates. This context has been and is crucial to how KfW operates and the successes which it has achieved. Any consideration of what lessons can be learned from KfW that might be relevant for the UK will need to take this national context into account.

From advising the German federal government on privatisation, to granting global loans to partner banks, as well as acting on its obligation to protect the environment, KfW fulfils diverse tasks, which are outlined in section V. Statistics on current actions and programmes along with relevant financial data, identification of KfW's stakeholders, as well as KfW's financing strategy, are discussed, and set the stage for the more detailed discussion of KfW's work on environmental and climate protection, now two of KfW's major concerns. Its recent and current work in these areas is described in section VI.

Section VII again broadens the view to that of Germany as a whole, showing how KfW's carbon emission reduction achievements have fitted in with those from the rest of Germany's climate policy. This then provides the basis for the discussion in section VIII of possible ways in which UK climate policy, especially in respect of reducing emissions from residential buildings, can be appropriately informed by and learn from the German experience.

III KfW's history

This chapter gives KfW's history as well as relevant background information on Germany. Foreign political interests laying the groundwork to establish KfW are explained along with KfW's funding in its early days. Following this, a summary of 60 years of KfW's most relevant activities until the present day is given.

III.1 Germany after WWII

After World War II Germany suffered intensely under the consequences of the Nazi regime. Surveys of the US Air Force showed that 20% of all dwellings, i.e. 3,600,000 units, were destroyed or heavily damaged during WWII. Principal cities like Hamburg or some cities of the Ruhr area were largely reduced to piles of gravel. The winter of 1946/47 was one of the most severe winters on record, bringing food and fuel supply as well as transport to a standstill, and aggravating the shortage of basic resources and food. Following this crisis, the USA and Great Britain took forward the idea of an 'Industrial Growth Plan', establishing a quasi-parliamentary 'German Board of Administration' which consisted of former German politicians with no close relation to the Nazi regime. One of the institutions appointed under this Board of Administration was the Economy Council, which less than a year later, was involved in laying the groundwork for KfW and a new banking landscape in post-war Germany (Harries, 1998).

Continuing American efforts to revive Europe led to the idea of the European Recovery Program (ERP), the official name of the Marshall Plan, which was introduced by US Foreign Minister Marshall to students at Harvard in 1947. The ERP seemed necessary as two years after the end of the war the Americans had spent over $9 billion on European aid programmes and saw only a few signs indicating a recovery of the European economy. ERP is of particular interest to the KfW as its leitmotif follows closely KfW's aims and objectives from its formation to the present day. Also, most of KfW's money spent during its early years originated from funds of this programme. Under the ERP, European recovery was to be stimulated through long-term investments in form of the supply of food, raw materials, and basic commodities, and the international trading regime was to be re-established. The recipients of these deliveries made payments for these supplies not to the US but in the form of the equivalent Dollar value of domestic currency into specially assigned accounts. The money accumulated in these accounts formed the 'counterpart funds', which were controlled by the respective states and the American 'European Corporation Administration' (ECA), which consisted of a 3,000 person-strong workforce and the Board of which was directly appointed by the President of the US. The assets from the counterpart funds were to be spent on domestic investments like coal production, food and agriculture, transportation infrastructure, manufacturing industry, and housing construction. The Marshall Plan countries included Germany, but also Austria, Belgium, Denmark, France, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and the United Kingdom.

The money in the counterpart funds was held in especially assigned accounts at the respective national banks (Ellwood, 2006, Hogan, 1987).

III.2 Reconstruction Loan Company (Kreditanstalt für Wiederaufbau, KfW): 1950-2000

In 1948 the Finance Advisers of the US and UK administered zone of Germany (the Bizone) issued the "Principles for the Reconstruction Loan Company", the KfW, as part of their construction of a new banking system for Germany. These Principles were subsequently taken on by the Economic Council of the German Board of Administration. KfW was set up with features, which included:

- The institution's capital was set to DM 1m. This was provided in equal shares by the Länder and by the German Board of Administration

- It is also worth noting that the Board of Directors (BoD) consisted of multi-disciplinary members. Among them were Directors for Food & Agriculture, Finance & Economics, three members from the Trade Unions, as well as representatives from the Housing Construction Industry, Agriculture Industry, and Trade Industry, along with 5 seats for representatives of the banking sector. The German Economic Council asked for a seat to be added for a representative of the Trade & Guilds sector as the involvement of this sector, along with a representative of the housing construction industry, seemed essential in face of the challenge posed to Germany by its building stock after WWII.

- The members of the BoD were all to be top representatives of their field, each bringing in extensive knowledge[2].

- The day-to-day work of KfW was carried out by the Board of Managers (BoM) which consisted of 4 members elected by the BoD.

- The Germans also received approval of the Allies on their request to operate KfW under their own, German, supervision.

(Bundeszentrale für politische Bildung, 2010)

Since KfW's capital was limited to DM 1m other means of external financing had to be explored. Loans from the German Administration or from foreign countries were not available. Eventually, money from the ERP counterpart fund, which was under American control, was transferred to the German government in 1949 as 'Special Assets' and was then handed out as KfW loans. Long-term investments in agriculture, infrastructure,

[2] KfW is set up in the same way today. 37 members supervise the conduct of business of KfW. The board members today are appointees of the Bundestag and the Bundesrat, representatives of banks and savings banks as well as of industry, the municipalities, agriculture, trade, the skilled crafts, the housing industry and the trade unions.

housing, mining, and any other industry were crucial for German recovery at this time after WWII. None of the 'regular' banks seemed interested in serving this purpose as most of their money went into short-term investments with a quick and potentially more secure return of their money and profit. On these grounds KfW is regarded as one of the main promoters of the economic miracle in Germany and put Germany, in contrast to other ERP-receiving countries, which had taken up even higher payments from the ERP, back into a leading role within Europe (Bundeszentrale für politische Bildung, 2005). By the end of 1950, KfW had disbursed DM 3.2 billion[3] in loans to the economy. Out of this, more than three quarters came from the counterpart funds (Grünbacher, 2004).

The following section follows six decades of KfW's developments in housing construction and low-carbon or environmental investments from its formation to the present day. Since KfW's history is closely connected to the economic and political development of the Federal Republic of Germany, the setting for these conditions will be briefly described.

The 1950s

The 1950s are probably one of the most interesting decades for KfW in Germany. In 1955 alone the economy as well as the real income in Germany grew by 10%. The number of cars on the street went up by 19% and whereas in 1940 two million people were unemployed, in 1955 the first migrant workers arrived in West Germany. Between 1950 and 1960 the gross national product doubled and exports quadrupled, putting West Germany in second place in the list of economic powers. Other countries benefiting from the Marshall Plan realised similar growth (Giebeler et al., 2009). The Soviet Zone became more and more separated from the US, UK and French Zones (which were by then substantially integrated) and from 1952 border-type barriers were erected towards the west restricting travel and movement of their residents.

In 1953 the ERP special assets of the counterpart funds were legally separated from the German federal budget by law. Before this, the counterpart fund was held in accounts under the, mainly American, Military Governors who controlled the release of money from the funds and, through this, had an influence on the German economy. In order to ensure continuing American influence on the money in the counterpart funds, in 1950 the Bilateral Agreement was the first treaty to be signed by the German government with a foreign power. As a result the counterpart funds were eventually handed over to the German Republic and its Ministry of the Marshall Plan subsequently managed these assets. It was however demanded by the Americans to keep the money in separate accounts, as Special Assets, only to be utilized with American permission. As these assets had to be maintained, the money was usually given out as interest-bearing loans. Interest and repayments had to return into the Special Assets, resulting in a constantly increasing revolving fund. Since the funds were separate from the national budget they were not subject to annual debate over the distribution of the budget and were therefore available

[3] These and subsequent figures are given in money of the day and would need to be adjusted for inflation to compare them with current money figures. In 1999 the German currency became the Euro (€), with €1 = DM 1.96

as a secure source for long-term investments in the economy or in any government project like housing construction or, later on, climate protection. From 1949 to the present day KfW has been allowed to use the money from the counterpart funds in order to finance investments in the economy, making the counterpart fund KfW's most relevant source of refinancing (Grünbacher, 2004).

In addition to reviving the economy, at this time in particular the coal and mining sector, and founding KfW as a banking institution, the 1950s were marked by KfW's two main areas of concern: the housing situation and energy supply.

Before the two world wars the housing situation in Germany was still under pressure from a general shortage when in the late 19th century, as a result of the industrial revolution, more and more people moved from the countryside to dense urbanised areas, like the Ruhr area, seeking employment. Due to the destruction of around 3.6m dwellings during WWII, in some German cities like Cologne less than 30% of the residential building stock remained intact (D'Olier et al., 1945). Furthermore, the number of refugees in the country was an additional problem in the 1950s. The number of refugees and displaced persons rose from under 10m in 1945 to 16m in 1950. It is thought that in 1950 the Federal Republic experienced a 6m dwellings shortage as a result of the conditions outlined above. The production levels of new dwellings were at a low level in the 1950s compared to pre-WWII levels of 350k dwellings per year as construction material and qualified craftsmen were largely unavailable. In 1939 1.3m people were employed in the housing construction industry, in 1944, this number came down to just over 600,000 people, of whom half were German. It was estimated that with post-WWII output levels of 250k dwellings per year it would take up to 25 years to rebuild the housing sector in Germany. Moreover, housing construction was not cost-effective as the rent was too low to cover the cost of the capital, i.e. interest and repayment. With insufficient housing available, the German government prioritised housing construction through KfW in order to avoid social and political dissatisfaction. Moreover, housing was seen as a cornerstone to stimulate economic growth and to restore productivity levels throughout the economy. As a result of this, 50% of the investments into housing construction came from public sources, making this part of the economy "the prototype of state intervention" and the birth hour of large-scale government housing construction programmes like the first Housebuilding Act[4] (Grünbacher, 2001, Statistisches Bundesamt, 1972). Under this act, the government promoted the construction of dwellings by giving out interest-free building loans. The money, which came directly out of the Federation's (Bund) and the state's (Länder)

[4] This legislation specified the size of apartments (32-65m^2) as well as maximum rent of DM 1 per square meter of floor area. The average floor area per occupant in 1950 was 14m^2 and rose to 19m^2 in 1960. (Today the average floor area is three times as much as it was in 1950.) Furthermore the Housebuilding Act pointed out that the building sector was a key industry forming a suitable starting point to combat unemployment in general. It was realised that confined living conditions had a negative impact on performance at work. If the German economy was to recover, improvement of the housing situation was required.

budget funds, had to be repaid over a period of up to 35 years. It was granted through the relevant Länder under the condition that the home erected would be made available to the broad public for the duration of the repayment of the building loan (Institut für Industrielle Bauproduktion, 2009). This situation also laid the groundwork for housing co-operatives and societies as well as social housing construction[5] programmes in Germany. Especially since most German families did not possess the required funds to build a new home, from 1949 to 1978 the Housebuilding Act, helped Germany to triple the number of dwellings available. In 2002 in the former West-German states, homes from this period form more than 50% of the stock making this an important characericstic of the stock. In 1956 the second Housebuilding Act was implemented, specifically targeting the distribution of homes to low-income households.

Public money was raised for housing construction in four areas:

- Property debt conversion: This came from the currency reform, in which money was converted from Reichsmarks to Deutsche Marks at a ratio of 10:1. In order to avoid home owners cutting their mortages by 90% overnight, those 90% were taken into trustee accounts on which the Federal States could draw to invest in housing construction.

- TheFederal Ministry for Housing Construction gave guarantees for loans for housing construction.

- Construction or re-construction of small dwellings qualified for reduced property tax.

- Federal States were allowed to draw on repayments for existing, pre-war, mortgages. DM 6.8bn were raised through this out of which DM 2.4bn went into housing construction.

With the average building cost of DM 8,500 per dwelling[6], KfW provided on average a third of this investment by means of ERP Special Assets. As a result of these efforts output levels were increased from 200,000 dwellings per year at the beginning of housing construction in 1949 to 560,000 dwellings in 1956. The share of social housing out of the new dwellings dropped from 70% in 1949 to 50% in 1956. This was partly due to the fact that under the Housebuilding Act, private builder-owners received interest-free loans with a 30 to 35 year payback period. In 1954 the numbers of dwellings already matched pre-war levels. The homes built during this period were typically built in estates. They were normally functional, sunny, airy, green, and most of them not higher than four

[5] 'Social Housing' in Germany in the 50's meant the flats were built with public money and had to be suitable for the widest class of population. As a result of this, roughly two thirds of these flats were occupied by mid-income people and, unlike in the UK, were not allocated on the basis of need.

[6] The average monthly gross pay of an industrial worker at that time was around DM 300

storeys. Furthermore they were equipped with a balcony or loggia and had a generous distance to the neighbouring building. The apartments were usually quite small in floor area, children's rooms measuring around 6m^2. The ceiling height was reduced by 20cm, compared to pre-war periods, to 2.5m and the internal walls were normally load-bearing for cost-saving reasons. As the energy supply was still short from the consequences of WWII the first German Institute for Standardization (Deutsches Institut für Normung e.V., DIN) standard on energy-saving construction was published in 1952 (Giebeler et al., 2009). In 12 years, six million dwellings were built in half the time originally estimated. These dwellings can be easily recognized for the typical construction features outlined above. The output ratio peaked at 99 dwellings per year per 10,000 inhabitants. KfW considers that the housing construction programmes provided a solid foundation for a stable economy and political as well as social recovery from WWII (Grünbacher, 2001).

The second area of KfW concern in the 1950s was energy supply, mainly in the form of coal. From 1949 until 1953 50% of the overall credit volume went into electricity generation and coal production. At this time electricity production solely relied on black coal. KfW was able to give out loans to mining companies, even when the ownership was still unsettled.

KfW's 1950 facts:
Balance sheet total DM 2.6bn
Loan commitment DM 3bn
Number of employees 105

The 1960s

The continuous growth from the post-war period, which was initially characterised by shortages, carried on until it peaked in 1964 when West Germany hit the first post-war recession. Until then Germany was marked by a stable government, full employment, and social satisfaction. In 1964, 1.4m babies were born, twice as many as in 2006. The population had grown from 68m in 1949 to 78m in 1970 as a result of the birth rate, migrant workers arriving in Germany, and approximately 3.5m German Democratic Republic emigrants. In order to stop the latter from leaving the Soviet Zone, the Wall was erected in 1961 establishing the West German/East German border. Architecturally, the town centres had been re-developed and the existing housing demand was fulfilled by new towns in the form of autonomous estates or satellite towns. As wages rose, and prices of building materials fell the new developments were using different methods like pre-cast concrete. Those developments were designed on the drawing board and were built outside the centres in previously undeveloped areas or where existing architectural structures were wiped out. Only a few European cities managed to escape this development. Vienna and Salzburg for example protected large areas of their city centres under the Venice Charter from 1964, which introduced conservation and restoration "not only of a single architectural work but also of the urban or rural setting". KfW's main areas of concern were abroad (Giebeler et al., 2009). Domestically KfW invested in KMU (Kleine und mittelständige Unternehmen, Small and Medium Size Enterprises or SMEs) as well as into the steel industry through-low interest loans. Until the 1980s, when

refurbishment schemes were launched, the existing housing sector was outside KfW's remit. The same applied to the German government. In 1963 the government initiated the transfer of the heavily regulated housing market into a free market economy where social housing would be financed through credits at market conditions. This had an impact on the numbers of new homes completed as in the late 1960s the numbers of dwellings completed dropped for the first time since the end of WWII and at the same time tenants experienced steep increases of rent. The government assumed that forecasted increases in annual income would compensate for this additional financial burden on households. However, contrary to the government's expectations, Länder and Communes had to release funds to compensate households for the additional financial burden regionally (Institut für Industrielle Bauproduktion, 2009). Perhaps the most important activity of KfW in the 1960s was export financing. Buyers of German products from abroad received their means of payment from KfW in the form of buyer's credits. Power plants or industrial plants were assembled domestically and then exported to Pakistan, Mexico, Chile, Spain[7], and Greece. KfW also financed the construction of power plants in neighbouring states which supplied German companies like RWE with electricity. Furthermore, KfW's investments went into developing countries in the form of development aid.

KfW's 1970 facts:
Balance sheet total DM 22.8bn
Loan commitments DM 3.6bn
Number of employees 524

The 1970s

As a result of the construction effort put into residential buildings in the post-war decades half of today's building stock in Germany was erected between 1949 and 1978 (IEA, 2008b). In 1973, the annual rate at which new buildings were added to the stock peaked at 714,000 units. However, the 1970s were influenced by the two oil crises as well as a sustained period of high interest rates of 10% and more forcing KfW to focus more on domestic activities. Export activities were still ongoing as power plants, ships, and aircrafts were still being sold abroad. The shortage of fuel supplies however for the first time introduced energy-saving measures to KfW's agenda. Emerging legislative efforts of the German government to tackle the shortage of fuel supplies through reduced energy consumption in housing will be discussed in detail along with the relevant KfW programmes in the following section.

Up until the first oil crisis in 1973, one of the few criteria in housing construction was to provide adequate living space. However, when the oil crisis resulted in a steep increase in the oil price, this attitude changed radically and awareness of the uncertainty of future fossil fuel supplies rose. As a result of this the Energy Conservation Act (EnEG) was implemented in 1976. Today, this act still functions as the legal basis for one of the most

[7] At that time Spain was still treated as a developing country.

important policies, the German Building Energy Conservation Ordinance (EnEV). EnEV's predecessor legislation is the Thermal Insulation Ordinance (Wärmeschutzverordnung, or WSchVO), which came into force in 1977. WSchVO's ultimate aim in 1977 was to reduce the energy demand for space heating through increased insulation for new buildings. Through this first step, the notional energy demand was cut by a third from the previous level of 250 to 350kWh/(m^2a) (Schroeder and Lowe, 2009). KfW promoted investments into environmental protection through subsidised interest rates which were even cheaper than the 'regular' KfW loans.

Besides energy conservation the second item on KfW's agenda in the 1970s was innovation. KfW had to tailor new investment programmes, mainly for the SME sector, designed to counter external conditions, which threatened the prosperity of the German economy. 1971 saw the re-birth of the KfW effort to promote economic development in Germany. The KfW "M-Programme" was launched in 1971 to provide SMEs access to cheap borrowed funds. By the end of the 1970s SMEs in Germany had received loans for the amount of DM 6bn and were regarded as the driving force of the German economy. From 1979 SMEs were also allowed to borrow capital for investments abroad. In the energy sector KfW promoted the construction of local district heating networks as well as natural gas and black coal power stations in Germany (KfW, 2010b).

Under the leadership of the Social Democrats the German government put the focus back on the construction of social housing. The threshold for people eligible for social housing was lowered compared to the previous legislation in 1956, so more low-income people gained access to social housing. Furthermore, the new regulation only allowed very poor households with an income of 20% less than the average of German households into already existing social housing. In addition to the above, the individual Länder provided secondary funding through loans regionally (Institut für Industrielle Bauproduktion, 2009).

In terms of buildings policy, the German government at the end of the 1970s went through a period of re-orientation, away from fostering new construction, and for the first time promoted the refurbishment of existing dwellings in 1976. Firstly, tax relief schemes in form of depreciation expenses, reducing taxable income, which were previously only applicable to new buildings, were extended to refurbishments. Secondly, government launched the 1976 Housing Refurbishment Act (WoModG). The central aim of this legislation was to bring the housing standard[8] of existing buildings to the typical (and increasing) standard of new housing in the 1970s. In 1978, WoModG was superseded by the Refurbishment and Energy Conservation Act (ModEng). Through this amendment the German government reacted to the oil crisis beginning in the 1970s and the associated rising fuel cost and began to promote technical interventions to reduce the energy consumption of dwellings (Institut für Industrielle Bauproduktion, 2009).

[8] In the mid 70s 3m West-German homes still had no internal bathroom and 11m homes were without central heating.

KfW's 1980 facts
Balance sheet total DM 53.7bn
Loan commitments DM 10.2bn
Number of employees 686

The 1980s

In the late 1970s and beginning of the 1980s the German economy still suffered the consequences of the surges in oil price which followed the OPEC Oil Embargo and the Iranian Revolution and which had a knock on effect on real incomes. The main political effort therefore was to introduce structural changes, reduce excessive national debt, introduce tax relief for companies, and fight inflation. The thrust of the new Kohl government in brief was "less state intervention, more market domination". Whether the economic upturn from 1982/83 was due to the efforts of the new government or to external events such as the collapse of the Bretton Woods conference agreement is unclear. The key for Germany's economy was the return to stable growth. The unemployment rate however remained high at 9% towards the end of the 1980s. KfW continued efforts from the previous years in the 1980s, but its activities were also influenced by the international debt crisis. Domestically KfW promoted the building and construction industry through extended programmes under the previously mentioned "M-Programme" scheme as well as under housing construction programmes to create additional living space in already existing buildings (KfW, 2010b).

KfW's 1990 facts
Balance sheet total DM 134.7bn
Loan commitments DM 33.2bn
Number of employees 954

The 1990s

The 1990s in Germany were marked by the collapse of the Soviet occupied zone, the German Democratic Republic. KfW was challenged through the fall of the Wall and forced to launch the biggest public investment programme in German history. The "Aufbau Ost" ("Build Up East") required KfW to devote 70% of the German domestic economic public investment to the New Länder by the mid 1990s. Overall KfW injected €130bn into the economy, local authorities, and private investors in East Germany. For comparison, the Marshal Plan 'only' provided €1.7bn[9] over the years from 1949 to 1953. The money invested in East Germany was mainly used for the world's largest public investment programme to repair and refurbish existing dwellings, the Wohnraummodernisierungs-programm – the refurbishment of 3.6m dwellings[10] was financed through KfW in just over 10 years. In the early years of this programme the money was mainly used by owner-occupiers and private landlords but later on institutional clients, i.e. housing associations,

[9] Converted at € 1 = DM 1.96, and in money of the day, i.e. not taking inflation into account

[10] Equalling half of the stock from the foundation of the GDR.

used money from this programme to refurbish East German Plattenbauten from the 1960s.

Another sector in East Germany subject to heavy intervention in the 1990s through KfW was medium-size enterprises, where 2.5m jobs were created or secured through the €50bn given by KfW. The 1990s also saw the foundation of Germany's efforts to reduce CO_2 emissions from buildings, which is discussed in Section V 'KfW today'.

As a response to globalisation through the 1990s, KfW not only financed German companies' investments abroad, but also foreign companies' investments in Germany. KfW's policy on developing countries in this period focused on 'Good Governance' with recipients of KfW funds having to obey certain conditions, i.e. conservation of resources, or the environment. Finally, KfW's expertise was applied advising Eastern European States engaged in transforming to free market economies (KfW, 2010b).

KfW's 2000 facts:
Balance sheet total €223.1bn
Loan commitments €36.2bn
Number of employees 2,032

KfW's activities since 2000 are covered in section V, KfW today.

Conclusion

This brief discussion makes clear that KfW is a major German public institution, with its roots in the post-WWII reconstruction effort, the remit of which goes far beyond the refurbishment of existing buildings to make them more energy efficient, even though this is now a major focus of KfW. There can be little realistic prospect of 'transferring' KfW experience to other countries, given its unique historical background, and any attempt to learn lessons from this experience in order to apply them in other countries should always bear the KfW context and background in mind.

IV The Context for KfW Today

IV.1 Energy and Climate Change Policy in the EU

The evidence for climate change, linked to over-reliance on shrinking supplies of fossil fuels, is widely accepted by the most respected scientific circles around the world (NRC, 2010). By 2030, world energy consumption is forecasted to increase by about 60 percent, and fast developing countries will account for two-thirds of the increase. But previous and ongoing high energy usage in the West is by far the biggest factor behind climate change for the foreseeable future (Stern, 2007).

The threat of energy insecurity and high energy costs underlines the urgency of energy saving, and it is widely accepted across Europe that investment in energy saving shows by

far the quickest and surest return on investment, producing a net negative cost over the investment's lifetime (McKinsey, 2009). Achieving greater energy security, lower energy costs, and more certain long-term accessible energy supplies are all critical issues.

The European Union (EU) is leading the world in setting ambitious targets for reducing energy use, increasing energy efficiency, and expanding the production of renewable energy in order to drastically cut greenhouse gas (GHG) emissions, the most prominent of which is carbon dioxide (CO_2).

Under the Kyoto Protocol the European Union agreed to reduce GHG emissions by a total of 12.5 percent by 2012 compared to 1990 (UNFCCC, 1997).

In 2007, the European Union established a triple goal by 2020 to achieve:

- 20 percent reduction in CO_2 emissions (to be increased to 30 percent in the context of a global agreement);
- 20 percent reduction in energy use below a 2020 projection;
- 20 percent of all final energy from renewable sources

In spite of this ambition, some European countries are still increasing their overall GHG emissions, although much more slowly than before. By contrast, Germany, which is by far the biggest emitter in the EU, has done the most to reduce its emissions and is on track to hit or exceed EU-wide targets. The United Kingdom is also reducing its emissions, though at a slower pace than Germany.

The EU depends on imports for over half of its energy supply. Oil makes up nearly two thirds of EU-wide energy imports; gas contributes a quarter, and solid fuels 13 percent. This dependence on foreign energy sources makes European countries extremely vulnerable to international tensions. Energy production within the EU declined steeply from 2004 onwards, and if this trend continues as expected, vulnerability to supply failures will increase unless Europeans shift from fossil fuel imports to drastic energy saving measures and an expansion in renewable energy production. Most European countries, including the UK, have less than 10 years in which to deliver large-scale alternatives to high fossil fuel reliance across the board, given EU commitments to CO_2 reductions (MacKay, 2009).

The EU is united in accepting that energy saving is the quickest and most cost-effective measure to secure its energy future. Buildings and building products are a major focus of EU energy initiatives because they are the biggest users and wasters of energy. In 2010, the EU set minimum requirements for energy performance in all new and existing buildings; it introduced mandatory energy performance certificates for buildings; and required modern, efficient heating boilers and air conditioning systems (European Parliament and the Council of the European Union, 2002).

Renewable energy is also seen as a vital but costly contributor to the shift to a "greener" future, which can only plug the gap in coordination with reduced energy usage (European Commission, 2008). Most European countries are rapidly increasing their renewable energy investment and investment in energy saving (Europe's Energy Portal, 2010). One-third of the EU's electricity supply should come from renewables by 2020; it had reached 16 percent by 2006.

Energy efficiency in buildings

Buildings are responsible for at least 40% of energy consumption and 36% of CO_2 emissions in the EU, more in Northern countries like the UK. Improving the energy performance of buildings is therefore key to achieving the EU's climate change and energy saving objectives; the triple 20-20-20 targets. The EU has set minimum requirements for energy performance in all new and existing buildings; it introduced energy performance certificates and requires modern, efficient heating boilers and air conditioning systems (European Parliament and the Council of the European Union, 2002). It developed three strategies:

1. The European Commission's Action Plan for Energy Efficiency, adopted in 2006, sets out a plan for residential and commercial buildings to save 30% of energy by 2012. Transport and manufacturing should save around 25% (European Commission, 2006). The Action Plan proposes:
    - Low energy heating and cooling;
    - Changing behaviour through publicity, labelling, training, education;
    - Eco-design and passive house standards (see later).
2. In November 2009, the EU strengthened its commitment by upgrading national building codes, and requiring all new buildings to be as near zero energy as possible by 2020. On 18 May 2010 a significantly tightened EU's Directive on Energy Performance of Buildings (European Commission, 2010), was adopted by the European Parliament to enforce the energy performance standards on all buildings, new or existing. Box 1 shows this plan.
3. In March 2010, the EU presented a new energy strategy, 'Europe 2020', led by Germany, expanding EU collaboration in energy research including carbon capture and storage (CCS); new technologies for extracting carbon from fossil fuels at source; large scale wind and solar energy (including in North Africa); and a European energy development network (BMWi, 2010b).

Box 1: EU Recast Directive on Energy Performance of Buildings (EPBD) (2002/91/EC)

The Directive on Energy Performance in Buildings (EPBD) was adopted in 2002. It is the main legislative instrument affecting energy use and efficiency in the building sector in the EU. The Directive tackles both new build and the existing housing stock. The 2002 Directive has now been replaced by a recast Directive that was approved on 19 May 2010 (European Commission, 2010).

Milestones

- **16 Dec. 2002**: EU adopts Energy Performance of Buildings Directive (EPBD)
- **Jan. 2006**: Deadline for transposing directive into national law
- **14. Nov. 2008**: Commission proposes revision of EPBD
- **23 Apr. 2009**: Parliament adopts first-reading position
- **17 Nov. 2009**: EU reaches political agreement on directive
- **18 May 2010**: Parliament approves new legislation (official publication 18 June 10)
- **End 2018**: Public buildings to have nearly zero energy standards.
- **End 2020**: All new buildings to be nearly zero energy

The EU took an integrated approach to calculating efficiency standards. This extends beyond insulation to aspects like heating and cooling, and heat recovery and lighting installations. As a result, regular inspections of boilers and central air-conditioning systems and assessments of heating installations that include boilers more than 15 years old were made mandatory. Moreover, alternative systems like decentralised energy from renewables, combined heat and power generation, district heating and heat pumps must be considered in new buildings with a surface area above 1,000m². To promote greater public awareness and debate on energy savings in buildings, the directive introduced an energy performance certificate, which has to be made available each time a house is built, sold or rented out. The certificate should help potential buyers or renters to compare the building's energy performance against established national standards and benchmarks, and to consider any cost-effective improvements they could make. The public sector was expected to take the lead by displaying energy certificates in 'prominent' places in public buildings.

While European countries are rapidly increasing their renewable energy investment, the focus on energy saving is growing (Europe's Energy Portal, 2010). Most European countries, including the UK, have less than 10 years in which to deliver on large scale alternatives to fossil fuel reliance to meet the EU's 2020 objectives (MacKay, 2009). There is Europe-wide agreement that energy saving and energy efficiency offer the cheapest and most cost-effective ways to reduce energy demand, creating an unexpected openness to learning from Germany (LSE Housing and Communities, 2008), a big energy user with limited internal energy supply.

IV.2 Germany's Approach to Climate Policy

Germany is strategically located between eastern and western, northern and southern Europe. The country uses energy intensively, at a rate 10 percent higher than the UK (Europe's second highest per-capita user), partly because of the large part manufacturing plays in its economy, and partly because of its wealth.

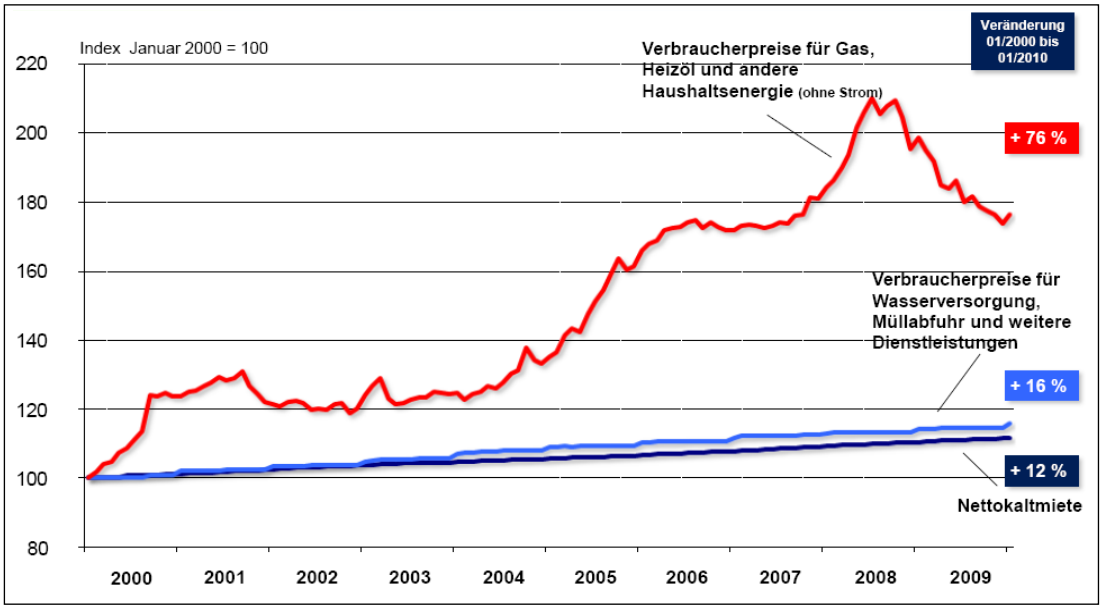
Germany is governed through a strongly federalist system, with decentralized powers and resources at the regional (Land) and city (Stadt) levels. Germany is also a highly regulated social democracy with strong public support for action on climate change. Climate change measures are a federal responsibility, but with strong implementation incentives at regional and local levels.

Germany's climate policy is focused wholly on energy efficiency and energy saving and promoting renewable forms of energy. Through sustained policy over many years it has become a world leader in the production of renewable technologies and the promotion and adoption of energy efficiency measures.

Germany's commitment to energy saving and alternative energy sources, depending as it does on 62% of its energy being imported, has been forged against a backdrop of energy in security, steep price rises and high CO_2 emissions. Figure 1 shows the contrast between energy price rises and other household costs in Germany.

In 2007 the German government agreed an 'Integrated Energy and Climate Programme' to deliver on ambitious targets for energy saving and renewable generation, aiming to reduce greenhouse gas emissions (GHG) by a total of 40% by 2020, 10% above the EU target of 30% reduction by 2020. Germany's Kyoto target (a 21% reduction by 2012) was achieved by the end of 2007. While existing measures can achieve a 30-34% reduction by 2020, depending on economic conditions, federal government officials argue that existing measures are insufficient to hit 40% (Menzer, 2010).

Figure 1: Rise in energy costs for gas, heating oil and other household users (excluding electricity) compared with rises in rent, water, waste and other household costs, 2000 – 2009



+76% Energy costs for gas, oil and other household energy (excluding electricity)
+16% Costs for water, refuse collection and other household services
+12% Net rent

Source: Statistische Bundesamt (2010) ‚Entwicklung der Verbraucherpreise für das Wohnen´ in *Fachserie 17, Reihe 7, Verbraucherpreisindex,* Monatswerte bis 01/2010. Available from: http://www.gdw.de

Energy demand in Germany

Buildings offer the greatest potential for saving energy in Germany, as in the rest of the EU.

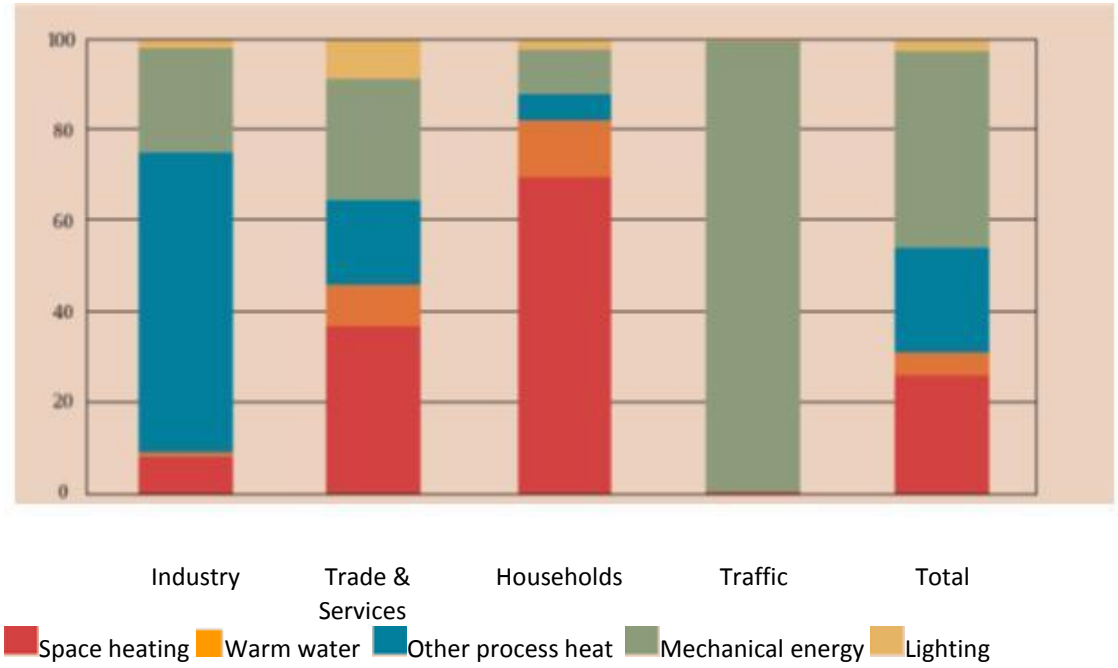
- Over 80% of energy use goes on heating rooms and water; the remaining 18% goes on electrical gadgets and lighting.
- Many experiments show that energy use in buildings can be halved through insulation, draughtft proofing, energy efficient systems and appliances and better controls (LSE Housing and Communities, 2008 - 2010). 20% of total energy use in buildings should be saved by 2020 through retrofit, avoiding 70 $MtCO_2$ (DENA, 2010).

Figure 2 shows the distribution of energy uses and the dominance of heating and hot water in the domestic sector. Big savings are possible in these areas.

New build vs. existing housing

Germany's housing stock totals nearly 40 million units, over half of which are flats in multi-unit blocks of flats and the overwhelming majority of which (99.5%) are already built. Single family houses comprise around one fifth of the stock. Figure 3 shows the distribution of the German housing stock, underlining the tiny proportion of new homes added each year.

Figure 2: Distribution of energy between activities by sector in Germany – 2007 (%)



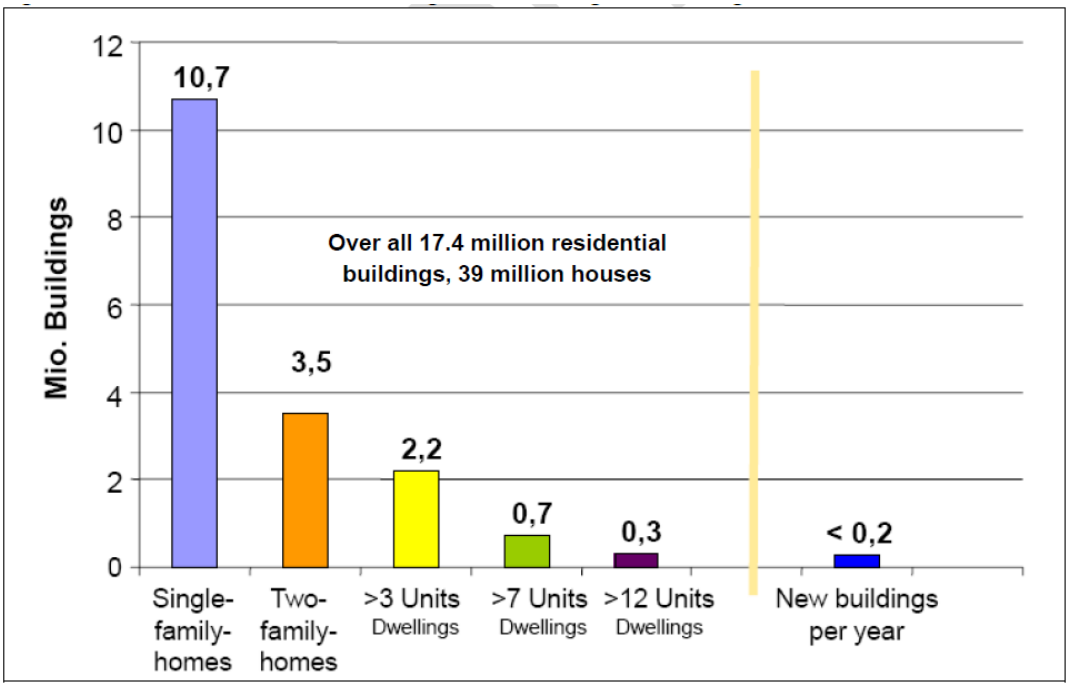
Source: Bundesministerium für Wirtschaft und Technologie (2009) *Energie in Deutschland. Trends und Hintergründe zur Energieversorgung in Deutschland* (German Ministry for Economics & Technology; Energy in Germany: Trends and Background to Energy Conservation in Germany [online]. Available from: http://www.bmwi.de

New buildings can be made highly efficient in their in-use energy requirements although the embodied energy in new buildings, new equipment, materials and fittings is huge with a forty year pay-back period (Power, 2008). However, new construction has plummeted in recent years and current building is the lowest since 1950, as in the UK. New building starts and completions have declined by almost 40% since 2003, with less than 200,000 buildings a year being built. Only the city states of Berlin and Hamburg have seen significant increases since 2003 (Statistisches Bundesamt, 2010). New construction is not expected to pick up in the near future (Kwapich, 2010b), in spite of some local shortages (DMB, 2010a).

Since the early 1990s, population decline, structural economic problems and rises in unemployment, particularly in East German regions but also in weaker West German regions, have affected housing demand and many parts of Germany now have a housing

surplus with 10% or more empty units in places. As city governments face increasing financial constraints, refurbishment and modernisation of existing homes become more attractive options (Müller, 2009).

Figure 3: Distribution of German housing stock including new buildings



Source: Kwapich, T. (2009) 'Germany's Investment in Energy Efficient Existing Homes', *The Great British Refurb: 40% energy reduction in homes and communities by 2020 – can we do it?*, London, 8 December 2009, LSE

Energy saving potential of existing homes

Around 40% of German homes are owner occupied (15 million units). A further 14 million are rented privately from small landlords. Over 10 million homes belong to larger commercial landlords and formerly non-profit but now legally private companies. This makes for dispersed and diverse ownership pattern, dominated by private renting. The need for energy retrofitting is huge since:

- 75% of homes (29 million units) were constructed before 1979, before any energy efficiency regulations were introduced.
- Around 9 million of the pre-1979 homes have been rehabilitated to high energy-efficiency standards, leaving 20 million still requiring rehabilitation.

In addition there are one and a half million non-residential buildings, including 40,000 school buildings and many other public buildings with huge energy saving potential (Schönborn, 2008).

Climate policy approaches

The federal German government acknowledges a "huge potential" for saving energy and CO_2 in existing buildings. Its Energy Strategy 2050 (BMWi, 2010a) is supported through federal special fund (Energy & Climate Fund) which is furnished with €3 bn annually. These funds are dedicated to the refurbishment of existing buildings as well as R&D for renewables and energy storage technologies (Bundesregierung, 2011). The building sector is a cornerstone of the Energy Strategy 2050. Here, Government's goal is a "climate-neutral building stock" by 2050. This is aimed to be achieved by:

- doubling the rate of energy-saving modernisation from 1% to 2% p.a.
- gradually reducing the energy demand for heating by 20% by 2020 and primary energy demand by around 80% by 2050, and
- covering the remaining energy demand predominantly with renewable energy.

The German Government follows a dual strategy combining efficiency gains and renewables. "Climate-neutral building stock" means: firstly, reducing primary energy demand of buildings, step by step and with a long-term perspective, by 80% by 2050, and secondly, covering the remaining energy demand predominantly with renewable energies (BMU, 2010b).

In this context the German government has announced that it will "include the climate neutral building standard, to be met by new buildings by 2020, in the Energy Savings Ordinance 2012" and furthermore "develop a renovation roadmap[11] for existing buildings cycles which starts in 2020, builds on the current renovation cycles for existing buildings and maps out a step-by-step approach for the building stock to reach the target of an 80% reduction of primary energy demand by 2050." (BMU, 2010b)

[11] BMU's definition of renovation roadmap: "The renovation roadmap is a new tool which has never been applied for a comparable timeframe. It should be noted that the roadmap builds on investment cycles that would be necessary regardless of the provisions of the Concept. If buildings are being renovated, then energy performance should be enhanced in the process. The German Energy Agency (dena) estimates that 50% of existing buildings will have to be renovated by 2030 for structural reasons alone. A major share of buildings will be renovated by 2050. We want to make the most of this opportunity. By building on structural renovations which would have been necessary anyway and by offering public funding for certain measures, energy upgrades will pay off within a reasonable period of time for both owners and tenants." (BMU, 2010b)

The German Government drives the development of renewable energy and energy-efficient construction and refurbishment of all types of buildings, both public and private, based on three pillars:

- Regulation to reduce energy demand and promote renewables;
- Creating financial incentives and stimulating investment to reduce energy demand and promote renewables; and
- Providing energy saving information and advice.

Some at least of the activities undertaken under these approaches may be expected to stimulate the economy, create jobs, and cause investment in infrastructure, which may be regarded as sub-objectives of German climate policy.

Pillar 1—Regulation

Energy Conservation Act, 2009 (EnEV)

Germany's primary legal tool in reducing energy use is the *Energy Conservation Act (EnEV)***.** Amended in 2009, it requires the following nationwide:

- Major changes to the building envelope (e.g., roof, exterior walls, window) must be made 30 percent more energy efficient, and the envelope must be 15 percent better insulated;
- Heating, hot water, ventilation, shading, cooling systems must be upgraded to include energy efficient, renewable technologies (e.g., solar thermal);
- Energy sources must reduce climate change impacts and CO_2 emissions (e.g., oil, gas should be increasingly replaced by renewable energies);
- Energy Performance Certificates are mandatory and energy advisers issuing them must have accredited qualifications (Ornth, 2009).
- EnEV 2009 for domestic new-builds is based on a calculation method called the Reference building procedure, or "Referenzgebäudeverfahren" in German, as described in DIN V 18599:2007-02. Using the Reference building procedure, the calculated annual primary energy demand of the actual building will be calculated and then compared against a notional building of the same geometry, identical usable floor space and orientation but with assigned U-values and prescribed heating systems.
- The results of the EnEV calcuation are issued on the energy performance certificate (Energiebedarfsausweis) which will be reviewed by the building control authority prior to issuing building permission.

EnEV is due to be further revised in 2011 and released as EnEV 2012 in 2012. Energy related requirements will be tightened by 30% compared with EnEV 2009. Bottom-up calculations estimate EnEV to be responsible for nearly half of the reductions in energy consumption from the building sector in the years 1995 – 2016. With the introduction of EnEV in 2002, the Thermal Insulation Ordinance (WschV), which prescribed insulation levels for walls, roofs, etc., and Heating Systems Ordinance (HeizAnlV), which prescribed minimum efficiency levels for heating systems, were merged. This holistic approach, along with enhanced energy targets based on primary energy rather than useful energy is estimated through bottom-up calculations to be the most successful element of German Energy Policy (BMWi, 2011). Over recent years for example oil fired boilers are hardly being installed in new builds whereas the numbers of heat pumps installed have increased continuously (Bigalke et al., 2011).

Heating Costs Act, 2009 (HeizkostenV)

This was first introduced in 1981, but was strengthened in 2009 to underpin the Integrated Energy and Climate Change Programme agreed by the EU in 2007. This act regulates the cost of heating and warm water in rented properties. As renters make up 60 percent of German households, these changes are significant. Tenants must now pay a much higher proportion of heating charges based on consumption, creating bigger incentives for them to save energy, and for their landlords to adopt energy saving measures (Haus & Grund, 2009).

Renewable Energy and Heat Act, 2009 (EEWärmeG)

A third key legal instrument is the Renewable Energy and Heat Act of 2009 (EEWärmeG), which entered into force on 1 January 2009. It stipulates that owners of new buildings must cover 15% of their heat supply with renewable energies. This applies to residential and non-residential buildings for which a building application or construction notification was submitted after 1 January 2009. The owner is free to choose which source of renewable energies is used. A certain technology-specific percentage of heat, dependent on the type of energy employed, has to be used. The Heat Act was amended in May 2011 through the "Act Implementing European Renewable Energies Legislation" (implementing Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources). This Act extended the obligation to use a share of renewable heat or cold from new buildings to also include existing public buildings undergoing major renovations (Tjardes, 2009). For private owners of existing buildings, the requirements of the Act are voluntary.

Pillar 2—Financial incentives and investment

Renewable Energy Sources Act (EEG), 2009

This act, first introduced in 2000, sets a target for electricity from renewable sources of 30 percent by 2020. Energy providers pay renewable suppliers a fixed payment per

kilowatt-hour, known as the Feed-in Tariff (FiT), which is in turn passed on to end-users (Höhne et al., 2009). The act has attracted major investment into renewable technologies and created a strong export market. The CHP Act of 2009 also provides for Feed-in Tariffs to be paid for electricity from modernised and new small CHP plants.

Government programmes to promote energy saving in housing have been in place in Germany since the 1970s. Incentive and support programmes are offered through four channels:

- the Kreditanstalt für Wiederaufbau (KfW)
- the federal government
- regional governments (Länder)
- municipalities

KfW programmes

KfW, the investment bank of the federal and regional governments, is the main funder of investment in energy efficiency and renewable energy, rather than the federal government itself. It delivers specific programmes agreed between the government and the KfW. The government negotiates conditions with KfW, including access to help, the amount of loan funding available, and the level of subsidy to reduce interest rates on loans. There is no legal limit to eligibility for loans and subsidies and there is built-in flexibility to allow some subsidy programmes to apply in exceptional cases (Höhne et al., 2009). Since 2006, federal funds of €1 billion per year through KfW supported a strong focus on the refurbishment of existing homes and other buildings. Between 2008 and 2011, the federal budget for KfW's energy efficiency programmes grew to €1.4 billion a year (Gumb, 2009). KfW's programmes are discussed in much more detail in Section V.

Federal government programmes

The German Federal government has three special subsidy programmes for existing buildings in addition to the programme it channels through KfW:

- A subsidy programme to increase market incentives for renewable energy (MAP). This is the government's main instrument for promoting the use of renewable energy in heating with the aim of reducing dependence on fossil fuels. MAP was introduced in 1999 and has grown continually since then (Baulinks, 2010);
- On-site energy advice, a programme increased in 2009 to help meet the costs of energy performance assessments and expert advice, required for funding applications, to the KfW refurbishment programmes; and
- A smaller-scale programme for refurbishing federal government buildings, including military buildings, and to test the use of new technologies and innovative methods for efficiency, including combined heat and power. This

programme formed part of the German government's stimulus package of 2008–2011.

Another important channel for the Federal Government to promote use of renewable energy and savings of energy is the Federal Office of Economics and Export Control (BAFA). BAFA is a superior federal authority subordinated to the Federal Ministry of Economics and Technology (BMWi) and provides grants on application. Under the programme "Local consultations to save energy" BAFA gives grants for consultations with homeowners by accredited engineers (energy advisers). Furthermore BAFA approves engineers' applications to become "accredited energy advisers" and publishes a central register of experts to be accessed by individual homeowners. Homeowners of detached or semi-detached houses receive €300 for an on-site consultation, multi-family homes of three or more housing units are entitled to €360 worth of grants. The grant is being paid from BAFA to the energy adviser directly and cannot exceed 50% of the overall consultation cost. Certain tasks, such as thermal imaging or blower door tests receive an extra bonus of €100 (BAFA, 2011b).

Other BAFA subsidy programmes are part of the Renewable Energy Incentive Programme and include grants for example for the replacement of standard boilers with condensing boilers (€600) or use of solar thermal for hot water and space heating (€120 per m^2 of collector area).

Regional and local programmes

There are 16 German Länder (regional governments) responsible for delivering energy savings at the regional and local levels. A total of 12,000 municipalities are responsible for 70 percent of public sector greenhouse gas emissions, and heating makes up 80 percent of those emissions. Municipal buildings (176,000 in total) are major contributors to the problem, making energy saving an urgent priority at the subnational level (Kwapich, 2010a).

Although German cities rank high on international sustainability indices, the investment gap is huge. It is estimated that more than €700 billion by 2020 would be required in order to raise their energy efficiency to Germany's exacting standards. In addition to KfW and other federal programmes, regional and local programmes to introduce energy-saving measures in the built environment abound. Municipalities often have their own energy investment companies, "Stadtwerke" (literally "city works"), which play a major role in energy infrastructure, energy provision, and increasingly energy saving and renewable energy. Hanover, with its own city and subregional energy agency, is one of the leaders in the field through ProKlima, a pioneer in energy-efficient refurbishment (Timm, 2010).

Pillar 3—Providing Information and Advice

The German Energy Agency (DENA)

DENA was founded by the German federal government, KfW, and three other major German banks in 2000 to test and implement innovative projects and campaigns on energy saving at the national and international levels. DENA operates as an independent, but government-sponsored, company with more than 150 staff. It links together government activity, subsidy programmes to promote energy efficiency, and market-oriented activities to spread the take-up of energy efficiency and renewable technologies.

DENA's activities fall into five main categories (Kwapich, 2009):

- Information and motivational campaigns to stimulate demand and spread information
- Training experts (engineers, architects, craftsmen) in new energy saving skills through documenting evidence and techniques, organizing events, and maintaining online databanks on: measures to achieve target efficiency levels in different buildings; refurbishment of rented homes; and best practices for residential and non-residential buildings (new and existing)
- Increasing transparency in all energy standards and certification (e.g., validated Energy Performance Certificates (EPC), a voluntary Quality Mark, Energy Efficient Building Displays)
- Developing and promoting model projects to demonstrate quality standards, implement best practice, and develop regional know-how
- Simplifying methods and increasing the reliability of renovation

DENA plays a crucial role as a conduit of information, expertise, and practical know-how, but does not directly provide advice, deliver projects itself, or handle funding for projects. Instead, DENA works with independent regional energy agencies to deliver specific projects. DENA sets out the standards, but regional agencies implement them and pass on the expertise to regional building organizations and professionals.

Federal Office for Energy Efficiency (Bundesamt für Energieeffizienz, BfEE)

In 2009 the Federal Office for Energy Efficiency (BfEE) was established at the BAFA. BfEE's main tasks are to gather data on relevant energy efficiency activities on national and European level, to publish a central database of providers for energy efficiency measures, to increase public awareness on energy efficiency, to set and monitor national energy saving targets, and finally to collaborate with third parties such as universities. BfEE is also directly involved with the Act on Energy Service and Energy Efficiency Measures of November 2010 which aims at increasing energy end-use efficiency through energy service and other energy efficiency measures in a cost-effective way (BAFA, 2011a).

Energy advice

Multiple projects and programmes, organized by DENA and financially underpinned by the Environment Ministry, fall under the "National Climate Protection Programme" targeting different groups, such as consumers, schools, local authorities and industry. Consumer projects aim to raise energy awareness and change behaviour, encourage the use of efficient technology and renewable energy, and promote emission-free travel in towns and cities. A special programme for schools and colleges funds energy-saving measures in educational buildings as well as developing teaching aids and teacher training; it also supports model projects to raise awareness of the urgency of climate protection. A local authority programme sponsors long-term climate protection ideas, including high-efficiency lighting systems in public buildings as well as the carbon-neutral modernization of school buildings. [12]

Targeting low-income communities

Local energy agencies, funded by the Environment Ministry, hire and train energy advisers to visit low-income households and organize local events, using local media and local parishes to inform residents through door-to-door visits offering free energy advice and equipment. Energy advisers are recruited from among local unemployed people. They must have some relevant building experience but they receive special training in advising low-income households on energy saving. They often come from minority backgrounds, which helps them communicate with mixed populations in poorer neighbourhoods. Households receive energy saving kits worth €20 (about $27) per visit, including low-energy light bulbs.

Online energy monitoring

The Federal Environmental Ministry supports the "Climate seeks Protection" (Klima sucht Schutz) campaign. The campaign provides online energy saving advice, then records initial energy costs, energy-saving measures adopted, subsequent levels of consumption, and user satisfaction, as well as the number of jobs created, both in supply chains and in building work itself. Behavioural change, material costs, employment outcomes, improvements in levels of comfort, and carbon reduction are all recorded, allowing DENA to document energy saving against costs.[13]

Model projects

DENA also promotes the development of model projects as learning tools and test beds for new ideas. For example, DENA developed and tested the standards for Low-Energy Houses (Niedrigenergiehaus) on 400 individual projects. KfW subsequently adopted these standards to support an additional 5,000 prototype buildings. In this way, the experimental approach strengthens frameworks for energy saving policies and practices

[12] See http://www.bmu-klimaschutzinitiative.de/en/projects_and_programs.

[13] See http://www.co2online.de

(Kwapich, 2010b). Pilot projects also inspire housing companies to adopt and promote energy saving while convincing the government of what works (Timm, 2010).

Energy Performance Certificates

DENA drives the adoption of Energy Performance Certificates (EPC), which have been introduced gradually for different types and ages of buildings since 2002. The EPC documents the energy efficiency of the building, and a colour code displays the energy performance of the building, with green for good, red for poor, brown to yellow in between. EPCs are now a legal requirement for all new buildings and must be produced when existing buildings are rented out or sold. DENA encourages much higher standards than the basic EPC. Similar energy displays and monitoring are now being widely adopted in the UK.

V KfW today

As already discussed, the economic and social framework in Germany has undergone considerable change throughout KfW's lifetime. It is now a bank owned by the Federal and Regional governments of Germany. All members of the supervisory board are appointed by the Federal government. The Board includes representatives of several ministries, the upper and lower Houses of Parliament, public and private banks, industry, associations of municipalities, agriculture, the crafts, trade and the housing industry, and trade unions.

The years since 2000 have seen an unprecedented change in KfW's organisational structure and activities. In the space of a few years KfW took over the following banks: Staatsbank Berlin, which had emerged from the state bank of the former GDR; Deutsche Investitions- und Entwicklungsgesellschaft (DEG) – a German bank for investments in developing countries; one third of Deutsche Industriebank (IKB) – a banking institution promoting German industry after WWII; and finally Deutsche Ausgleichsbank (DtA) – the German compensation bank for victims of WWII. In 2002 the German government and the European Commission concluded that KfW had to be divided into separate banking institutions under EU Competition Law. This resulted in a split of publicly funded promotional activities and commercial banking business (KfW, 2010b).

The integration of Deutsche Ausgleichsbank (DtA) and the continuous promotion of domestic and foreign economic development lead to a doubling of the refinancing volume in just a few years. Finally, the monetary union created unprecedented opportunities for KfW to act as an issuer on the capital markets. Today, KfW is one of the major players on the international capital markets. Its refinancing volume is geared towards the international market and serves investors from all over the world; 10% from Germany, 50% from the rest of Europe and 40% worldwide. Until the mid sixties, KfW

took up about €255m[14] a year on the capital market, which were mainly used for export financing. Since the first permanent KfW loan programme was established in the 70s, the demand for refinancing funds increased. Today, the yearly refinancing volume amounts to about €60 to 70bn (KfW, 2010b)

Furthermore, in the year 2000 KfW was involved in setting up a centre of expertise for energy efficiency and renewable sources, Deutsche Energie Agentur (DENA), the German Energy Agency (briefly described above). KfW is also a shareholder of Berliner Energieagentur, the Berlin Energy Agency, which is primarily targeting the Berlin market.

Today, therefore, KfW is a major financial institution active in both German and international markets. Its three key business areas in the German market are shown on the left in Figure 4.

Figure 4: KfW's business areas © KfW 2009

Each of the three core business areas in the German market has its own bank within the KfW group, which provide loans, grants and special subsidies in particular programmes geared to the different needs of the different bodies served. The activities are described in KfW's Sustainability Report 2009 (KfW, 2009b) as follows:

- Promoting SMEs and Start-Ups (the Mittelstandsbank)

  "The promotional offering open to start-ups and SMEs includes not only conventional, long-term loans, but also a range of new programmes aimed at strengthening companies' equity base. Both options are available to clients via their regular business banks. It goes without saying that this area of KfW's business also includes giving targeted advice."

- Construction, housing, energy saving (the Privatkundenbank)

  "With its "Construction, housing, energy saving" promotional programmes, KfW is helping more and more people to become homeowners, as well as financing housing modernisation projects. In this respect, environmental and climate protection are the guiding ideas."

[14] Euro-equivalent of the DM figure, converted at €1 = DM1.96

- Financing for municipal infrastructure projects (the Kommunalbank)

> *"KfW provides financial support to local authorities wishing to embark on infrastructure projects. These include sewer system modernisation, the further development of public transport networks or housing projects. Private-law companies or non-profit organisations that perform municipal tasks can also apply for promotional funding."*

Special consideration is also given to education:

> *"For a low-resource country like Germany that is on its way to becoming a knowledge-based society, education is of paramount importance as a production factor. The education level of a country's population has a positive impact on a country's productivity and innovative strength. More innovation means more growth and more prosperity. This is why KfW also provides students and skilled workers with low-interest loans to help them finance their training and further education."*

In summary, therefore, KfW:

- promotes particular activities through favourable finance mechanisms;
- grants loans and other forms of financing to regional and local authorities and special purpose agencies as regulated by public law;
- finances measures with purely social goals including educational development; and
- grants financial support on wider issues that are in the interest of the German and European economy.

Examples of its activities include start-ups for small and medium-sized enterprises, including professions and businesses; provision of risk capital; housing development and renovation; environmental protection; creation of infrastructure; technical developments and innovation; internationally agreed subsidy programmes; development cooperation. Other promotional activities relate to laws, regulations and official guidelines deriving from the federal or regional government related to economic policy.

In 2008 KfW had a balance sheet of €354bn, loan commitments of €87.1bn, and around 4,000 employees. The bank has a registered share capital of €3.75bn. The federal government participates in the share capital with €3 billion and regional governments with €750 million. However, the €3.3 billion towards the registered share capital is a one-off payment which remains within the institution. The rest of the share capital may be requested by the Board of Supervisory Directors of KfW from the government when required to meet the institution's agreed liabilities.

The Federal Government guarantees all obligations of the bank in respect of loans and bonds issued by the Bank, commitments or agreements entered into by the Bank and

other funds extended to the bank as well as funds extended to third parties in as much as they are expressly guaranteed by the institution.

VI KfW's Climate and Environmental Protection Programme

Up until the first oil crisis in 1973, one of the few criteria in building design was to provide adequate heating (Poeschk, 2007), and to avoid structural damage. This often led to oversized building services equipment. However, when the oil crisis resulted in a steep increase of the oil price, this attitude changed radically and awareness of the uncertainty of future fossil fuel supplies rose. As a result of this the Energy Conservation Act (Energieeinsparungsgesetz, EnEG) came into force in 1976. Today, this act still functions as the legal basis for the relevant German Building Energy Conservation Ordinances (EnEV). The first German ordinance improving energy efficiency was introduced in 1977, the Thermal Insulation Ordinance (Wärmeschutzverordnung WSchVO), and had the ultimate aim to reduce energy demand for space heating through increased insulation for new buildings. Through this first step, as noted above, energy demand was reduced by a third from its previous range of 250-350 kWh/(m^2a) (Kleemann et al., 2000). The first amendment to this legislation came in 1984 (WSchVO 84) as a result of the second oil crisis. Germany took the lead introducing ambitious CO_2 emission targets at the Rio conference in 1992 and subsequently introduced the second amendment of the Thermal Insulation Ordinance in 1995 (WSchVO 95). The main objective for this amendment was climate change mitigation by reducing CO_2 emissions. Under the EU-Burden Sharing Agreement relating to the Kyoto Protocol Germany committed to a 21% reduction of 1990 CO_2 levels by 2008-2012, the actual reduction in 2008 was 22%. The long-term goal is to achieve 80% by 2050 (BMWi, 2010a).

VI.1 CO_2 Reduction Programme (CO_2-Minderungsprogramm)

Measured by the ambitious targets from the Rio conference 1992 the efforts to reduce CO_2 emissions in the residential building area had to be stepped up as from 1990 to 1996 CO_2 emissions from this sector stagnated and showed no clear downward trend. This trend only changed with the introduction of the CO_2 Reduction Programme in 1996 following which CO_2 emissions from the residential stock began to decrease (KfW, 2009a). This programme is sometimes also referred to as "Programme 96". It was specifically designed to support the government's objective to reduce nationwide CO_2 emissions. The other two objectives of this policy were to support the weakening construction industry and to channel investment into the German infrastructure, including the building stock.

Before this programme was introduced in 1996, the only other existing programme was the 1990 Housing Modernisation Programme, which applied to the new Länder only, and which primarily aimed to make existing, dilapidated housing in East Germany habitable.

The CO_2 Reduction Programme first of all targeted existing buildings in West Germany requiring substantial energy saving investments. It was mainly applied for increased thermal insulation on buildings erected pre-WSchVO 84 as the potential energy demand reduction of these buildings was estimated to be in the order of 65 to 75%. Secondly, the energy efficiency of new builds was targeted as awareness rose that new buildings added to the nationwide carbon emissions inventory and therefore had to be as efficient as possible (KfW, 1999).

The CO_2 Reduction Programme provided long-term low-interest loans with fixed interest rates to those responsible for the energy efficiency investments, i.e. private owners, housing companies, municipalities and districts. KfW raised the funds for this programme on the financial market and passed the money on via commercial banks, most likely the borrower's own bank, to the applicant in the form of a lower-interest loan. Two mechanisms enable KfW to offer loans at preferential interest rates. Firstly, KfW faces low interest rates on the financial market as it is rated AAA due to the guarantees accorded to it by its public status. And secondly, federal funding allocated annually[15] in the national budget is used to further decrease interest rates. The repayment of loans is then used to pay back KfW's liability on the market. KfW loans have to be repaid but despite this they offer lower interest rates than commercial banks. The subsidised, decreased interest rate can result in savings equivalent to 7 – 12% net present value of the loan amount. After repayment-free start-up years the loan could even be repaid in one payment at no extra cost (IEA, 2008b). The debtor guarantees the fulfilment of his repayment obligation to KfW through a secondary land charge on his property. The first-ranking charge is normally assigned to the first mortgage from the initial purchase. This, the first-ranking charge, is the most secure right and no other charge can take priority. With the secondary land charge being sufficient as guarantee for KfW loans the borrower's collateral value, the loan-to-value ratio, of the relevant property remains irrelevant. Quite normally the interest rate of commercial banks depends on the collateral value of the property, such that the lower the loan-to-value ratio the lower the interest rate. However, KfW loans remain subject to a credit check and therefore approval through the on-lending bank. The borrower's loan-to-value ratio is therefore unlikely to be higher than 1.

Technical measures promoted under this scheme were:

- Retro-fit measures leading to increased insulation on walls (20.8%)*
- Replacement of windows (26.4%)*

[15] National budget account 2001 allocated the following funds to further decrease interest rates:
-KfW Housing Construction DM 41m (€ 27m)
-KfW Housing Modernisation (New Länder) DM 1,400m. (€ 715m)
-KfW CO_2-Reduction Programme DM 28m (€ 14m)
-KfW CO_2-Building Rehabilitation Programme DM 400m (€ 204m)

- Insulation of roof (8.2%)*
- Replacement of existing boiler with condensing[16] (24.9%)*
- Installation of CHP units
- Installation of solar-thermal, heat pumps, local district heating
- Measures leading to the application of renewable energy sources
- since 1998 the construction or purchase of new Low Energy Houses[17]

* Numbers in brackets indicate the share of total end-energy reduction for this programme from 1996 to 2001. 100% equal 15.9PJ.

The maximum amount granted under the CO_2 Reduction Programme was €5m per project, which had previously been restricted to €153 (DM 300) per square meter of living area, or up to €30k to 50k for each new Low-Energy House. The fixed interest rate (based on 1998) for loans under this programme ranged at around 5%, fixed for 10 years, with the average 10-year loan on the market being around 6.5% at the same time. In 1996 alone, 8.9 million m^2 of living area in over 100,000 existing buildings were promoted under this scheme.[18] Until the year 2004, when the CO_2 Reduction Programme ended and merged with the CO_2 Building Rehabilitation Programme (see below), 57million $m^2$of floor

[16] 40% of the 6m boilers in Germany were older than 15 years at that time.

[17] A Low-Energy House has a standard annual heat requirement for space heating of lower than 60 - 70 kWh/(m^2a) (detached house) compared to a Passive House with 15 kWh/(m^2a) (both useful energy). The energy demand of new buildings erected according to the WSchVO 95 standard is in the range of 130kWh/(m^2a), which includes space heating (100kWh/(m^2a) and hot water (30kWh/(m^2a). Other energy use is expected to be in the range of 30kWh/(m^2a) and is not included in the previously quoted 130kWh/(m^2a). In comparing historical energy-related benchmarks in Germany it is essential to understand the difference between the Thermal Building Insulation Ordinance "WSchV" (until 2001) and the Energy Savings Ordinance "EnEV" (since 2002). At first sight, both seem to deliver benchmarks for specific, floor area related, annual energy consumption "kWh/(m^2a)". However, WschVO provides benchmarks in the form of "useful energy" (i.e. heat) calcuated by means of heat-loss calculations accounting for transmission heat losses, internal heat gains, and ventialtion/infiltration only. EnEV benchmarks, in contrast, are in the form of "primary energy" and include, in addition, losses in converting energy on site, i.e. at boiler or local distribution level, and upstream conversion and transmission losses. Average primary, EnEV-based, energy demand for new-build detached houses in 2010/2011 is 57 kWh/(m^2a), and 45 kWh/(m^2a) for multi-family homes. These numbers undercut the minimum EnEV requirements of the "reference building" by 30% (Bigalke, 2011).

[18] Nationwide floor area in 1997 was 3bn m^2. Further statistics for 1995: population 81.7m, occupants per household 2.21, number of households 36.9m, average floor area per household 81.3m^2 (setting aside differences in definitions, this last figure is within ~10% of the UK figure).

area had undergone energy-efficient improvements in 685,000 existing homes, 1.7% of the stock (Kleemann et al., 2003). The average loan granted under this scheme was €8,160 per dwelling. It is estimated that from the years 1996 to 2000 16,400 jobs annually were created or secured through the CO_2 Reduction Programme. Due to the nature of the investments promoted under this scheme, i.e. building refurbishments, the impact on the domestic job market was high. From 1996 to 2000 each billion DM of credit volume (€511m) was directly or indirectly responsible for 16,800 jobs (KfW, 2000).

The economic functional chain of the CO_2 Reduction Programme is displayed in Figure 5. This shows that the CO_2 Reduction Programme reduced emissions from buildings, but also induced some CO_2 emissions through the manufacture and installation of energy-efficiency materials, and triggered investments (for example, in extra vehicles and equipment) not directly related to the measures covered by the programme. From 1996 to 1998 the total investments triggered were nearly twice as high as the KfW loans granted. A typical investment triggered by the CO_2 Reduction Programme not covered under the KfW loan was the extension of floor area or aesthetic refurbishment of the interior, i.e. renewal of the bathroom, or the kitchen, etc. (KfW, 1999)

Figure 6 shows the estimated net CO_2 reduction induced by the CO_2 Reduction Programme. The modelled cumulative savings achieved in 2001 were 1Mt CO_2 per year. Compared with the total CO_2 emissions from this sector the CO_2 Reduction Programme was responsible for a moderate 0.8% reduction of CO_2 emissions based on 2003 levels. However, the programme counteracted the general trend of an increased floor space per occupant and dwelling, which would have led to increased CO_2 emissions over the same period. The lessons learned from this first programme, which mostly promoted single measures, i.e. the replacement of boilers or provision of external insulation, were applied to the CO_2 Building Rehabilitation Programme (Programme 01). The latter was launched in 2001 and triggered annual investments of up to €3.5bn in energy efficiency measures in buildings.

Figure 6 indicates the inventory account for CO_2 emissions reduced through KfW's Programme 96 and Programme 01. From 1996 until 2001 1.03m tonnes of CO_2 were avoided as a result of KfW's CO_2 reduction programme. During the first year of this programme however, CO_2 emissions were increased through production and construction processes. Later, the cumulative savings exceeded these increases. The line displays the total reduction achieved over the years 1996 to 2001.

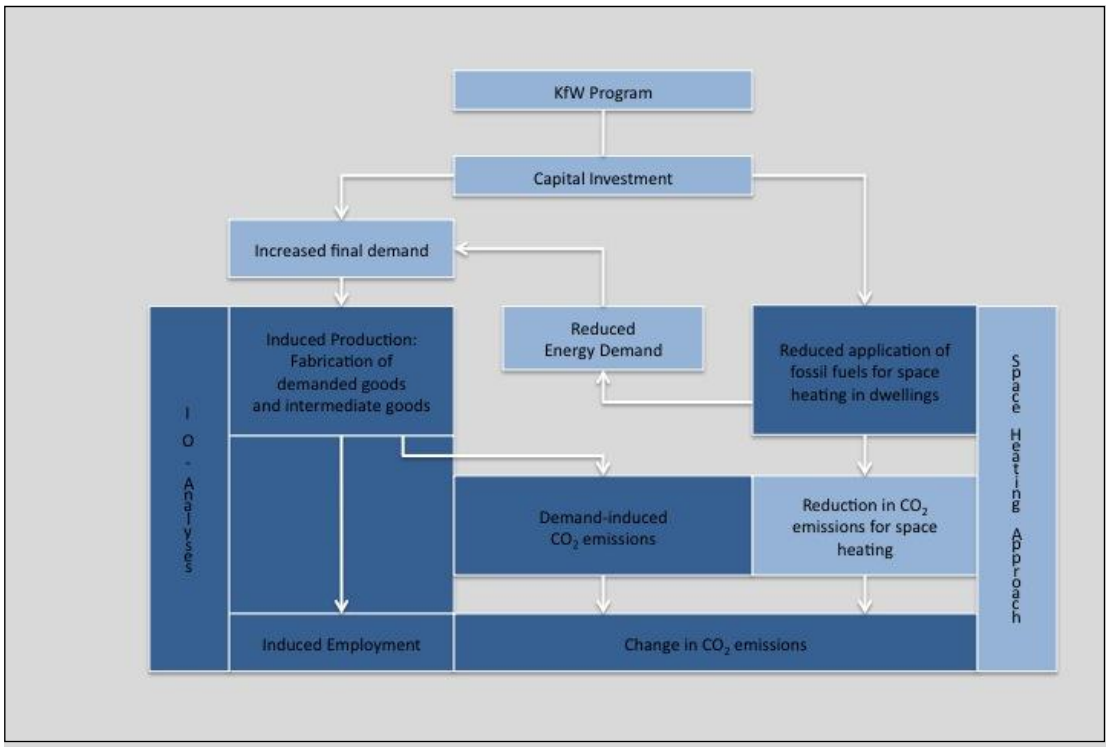


Figure 5: CO_2 Reduction Programme; economic functional chain, I/O Analysis © KfW

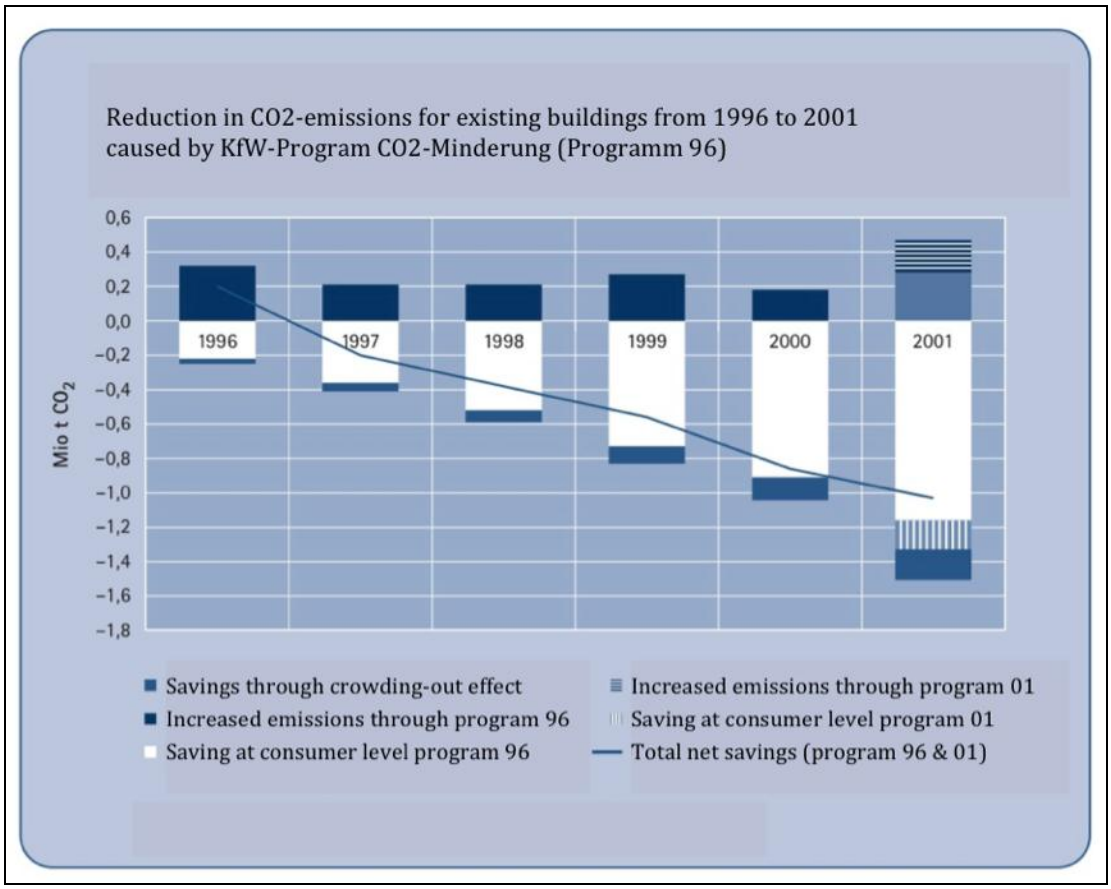


Figure 6: CO_2 Reduction Programme, CO_2 emissions from 1996 to 2001 © KfW

Crowding out in this context refers to the substitution of fossil fuels by renewables.

VI.2 CO2 Building Rehabilitation Programme (CO2-Gebäudesanierung)

Germany is thought to have reduced carbon emissions from the existing building stock over the period from 1990 to 2006 by 24%, achieved through KfW subsidy programmes for the renovation of existing buildings (Kleemann and Richter, 2008). A considerable share of energy savings (16.6 PJ per year) made in Germany in the years 1995 to 2007 can be attributed to the "CO_2 Building Rehabilitation Programme" (BMWi, 2011). In the basket of successful German energy policies until 2007 this programme is only second to EnEV which is the most successful policy instrument. Under the CO_2 Building Rehabilitation Programme more than €4bn were invested from 2001 to 2004 in order to improve the energy performance of more than 16.3m m^2 of living area within existing residential buildings. In the year 2006, each residential building funded under KfW's "CO_2 Building Rehabilitation Programme" is claimed to have reduced its CO_2 emissions by 59% (Clausnitzer et al., 2007). On current government funded building refurbishments the measured energy consumption is being reduced up to tenfold, i.e. the heating energy consumption was reduced from 275 kWh/(m^2a) to 25 kWh/(m^2a) of treated floor area (Enseling and Hinz, 2006). Accordingly, the German subsidy programme for existing buildings is considered "a big success" (IEA, 2007) and one of the few examples in Europe, where "long-term financial [policy] efforts (...) had considerable impacts in terms of energy savings and CO_2 emissions reductions" (Boonekamp and Eichhammer, 2007). The relevance of the KfW experience in this area, and the contrast to the UK, is shown by the fact that in the UK the energy delivered to dwellings has increased by 30% over the last 30 years (Oreszczyn and Lowe, 2005) and the residential building stock ranks amongst the least efficient in Europe (Fawcett and Boardman, 2009).

One of the reasons for the introduction of the CO_2 Building Rehabilitation Programme in 2001 was an insufficient exhaustion of the refurbishment potential from existing buildings, as under the CO_2 Reduction Programme mainly single measures were promoted. The refurbishments carried out under this programme did not sufficiently exploit the full potential of CO_2 reduction of the building. Too many sensible technical interventions were not applied under the CO_2 Reduction Programme, leading to an efficiency of the programme of only 32%, i.e. an achievable share of 66% further reduction in CO_2 was not explored[19]. Furthermore, the overall number of refurbishments was too small under the CO_2 Reduction Programme. Apart from triggering a combination of sensible technical interventions, the 2001 CO_2 Building Rehabilitation Programme also aimed to financially motivate property owners to extend any periodic refurbishment (of roofs, heating system, windows, etc.) in a way that technical interventions for improved energy efficiency were carried out at the same time (Kleemann et al., 2003). If Germany was to achieve the proposed reduction of CO_2 emissions it became increasingly evident that any periodic refurbishment had to include an energy efficiency upgrade as external plaster, roofs, and windows were only replaced every 40-60 years.

[19] The author observed for example, where external insulation was being retrofitted under the CO_2-Reduction-Programme, the old existing windows were not uncommonly left in place.

The targeted reduction of CO_2 emissions Germany agreed to achieve under the EU-burden sharing agreement was 21% less CO_2 emissions by 2008-12 based on 1990 levels. This equalled a reduction in nationwide CO_2 emissions of 218Mt. In 1990 households were responsible for 129MtCO_2 emissions. Under plans made in 2006 in the BMU Szenario 2020, CO_2 emissions of this sector had to come down by 27Mt to 102Mt by 2008-12 (BMU, 2006). From 1996 until the year 2000 the CO_2 Reduction Programme contributed a reduction of 1MtCO_2, or only 3.7% of the necessary reduction. In order to get on track to reach its target of reducing CO_2 emissions by 80% by 2050, the Government proposed in 2009/2010 to increase the rate of annual refurbishments from 1% of the total stock to 2%. In order to achieve this KfW funding for subsidised interest rates went up from €500m to €1.5bn. Furthermore, the amendment of the Energy Conservation Act (EnEV) in 2012 is going to lay out a roadmap for the years 2020 to 2050 aiming to create a carbon-neutral residential building stock.

Like the CO_2 Reduction Programme, the CO_2 Building Rehabilitation Programme offered low and reduced interest rates, long maturities with fixed-interest periods, redemption-free start-up years, and off-schedule repayments at no extra costs. The scope of works eligible for funding was increased so that works adjacent to the refurbishment, i.e. aesthetic renovations etc., were covered under the KfW loan. In this case public funding was increased to €5bn for the years from 2006 to 2009 to a) enable even lower interest rates since the efficiency of the Programme 01 was much improved and b) to accommodate the increased scope of works.

The CO_2 Building Rehabilitation Programme provided the beneficiary with a choice between pre-defined refurbishment packages, initially only applicable to buildings erected before 1979. Later on the age restriction was lifted to increase the number of buildings eligible for funding. KfW assumed an annual reduction of CO_2 emissions not less than 40kg per m^2 of living space induced through this programme. Out of the 6 packages of measures available (numbers 0 – 5 below) the packages 0 to 3 contained a pre-defined combination of technical interventions (KfW, 2003).

Package 0
- retrofitted insulation on exterior walls
- retrofitted insulation of the roof
- retrofitted insulation of the basement ceiling or of outside walls of heated rooms in contact with the ground
- replacement of existing windows

Package 1
- replacement of central-heating boiler
- retrofitted insulation of the roof
- retrofitted insulation on exterior walls

Package 2
- replacement of central-heating boiler
- retrofitted insulation of the roof
- retrofitted insulation of the basement ceiling or of outside walls of heated rooms in contact with the ground

- replacement of existing windows

Package 3
- replacement of central-heating boiler
- change of heating energy carrier
- replacement of existing windows

Package 4
- a combination of measures from packages 0 to 3
- proof of 40kg reduction of CO_2 emissions per m^2 floor area and year through calculations by an accredited energy adviser

Package 5
- replacement of a) decentralised furnaces fired by gas, oil, or black coal, or b) night storage heaters, or c) black coal-fired central-heating boilers with a heating system complying with EnEV.
  or
- replacement of standard oil- or gas-fired central heating systems installed before 01.06.1982 with oil- or gas-fired condensing boilers combined with solar thermal or other renewable energy sources, i.e. biomass

Provided that the works carried out under packages 0 to 3 met the requirements laid out in the EnEV, loans of up to €250 per m^2 floor area were given by KfW. The same applied to package 4 as long as 40kgCO_2/(m^2a) were saved based on primary energy demand. €80/m^2 were granted under package 5. Furthermore, borrowers were allowed to combine investment programmes.

Table 1 gives some outcome data for both programmes for existing buildings up to 2001.

	loans	annual savings	annual savings	interest rate	maturity	annuity	savings performance	
	€/unit	kWh/unit	t CO_2/unit	%	years	€/unit	€/kWh	€/t CO_2
Program96	8,743	10,505	2.81	4.96	10	1,130	0.108	402
Program01	16,555	19,788	5.22	2.93	10	1,934	0.098	371

Table 1: Results for CO_2-Reduction-Programme (96) and CO_2-Building-Rehabilitation-Programme (01) unit = dwelling

Box 2 gives an example of KfW financing, which shows the savings from a KfW loan compared with a conventional bank loan. The loan was given for a 120m^2 floor area detached house built in 1932 to be refurbished to KfW standards with Package 2 (i.e. existing boiler replaced with condensing boiler, replacement of existing windows, as well as insulation retrofitted on the roof and the basement ceiling), and was financed from a number of KfW funding streams.

-	assumed investment cost	€45,000
-	loan under CO_2-Building Rehab. Programme 120 x 250	€30,000
-	loan under CO_2-Reduction Programme	€5,000
-	loan under the "Housing Modernisation Programme"[20]	€10,000
=	savings compared with conventional bank loan	€14,000

Box 2: Savings arising from a KfW financing package
Source: (Stiftung Warentest 2003)

The interest rate on the KfW CO_2 Building Rehabilitation Programme was set to 1.3% (20-year-credit period) or 1.6% (30-year-credit period), when the market interest rate was 4%. The borrower also received a subsidy of 20% for refurbishments of existing buildings to an energy level corresponding to the EnEV for new buildings, or 30% below the 1984 Thermal Insulation Ordinance's standard. In November 2004 the subsidy was reduced to 15%. From 2006 on the programme was furnished with €1bn per year until 2009 and the criteria for subsidy were set as follows (IEA, 2008a):

- 17.5%, up to €8,750 per dwelling if the energy consumption is at least 30% below the new construction standard.
- 10%, up to €5,000 per dwelling if the energy consumption is below the new construction standard.
- for buildings completed before 1995, 5% or up to €2,500 per dwelling for other bundles of measures "with considerable savings".

In 2008 the CO_2 Building Rehabilitation Programme was responsible for 36,000 loans, subsidies worth €2.9bn, and created or secured around 225,000 jobs. 134,000 dwellings were energetically improved leading to a reduction in energy use of 1,530 GWh per year and at the same time reducing CO_2 emissions by 58%. Furthermore, the occupant's heating bills were halved with aggregate savings of €3.1bn.

Between 2006 and 2009 €1bn per year was saved in reduced heating costs due to KfW energy-saving loan and subsidy programmes (KfW, 2010c). Allowing a thirty-year life for building investments, and twenty years for renewable technologies, the energy-saving measures will achieve an overall long-term saving over the life span of the products of 288MtCO_2 (KfW, 2010c), and it is estimated that the accumulated savings over the same

[20] KfW loan for building renovation without energy-efficiency improvements. Infrastructural investment programme.

period will cover 97% of the investments (KfW, 2009c). Energy efficiency work has halved energy use in buildings since 2002 when the first energy efficiency building regulation (EnEV) came into force - from around 120 kWh/(m^2a) to 60 kWh/(m^2a) in new buildings and to around 80 kWh/(m^2a) in existing buildings following retrofit (Menzer, 2010).

VI.3 KfW's current procedures and processes

In April 2009 the previously introduced KfW programme ceased to exist and were replaced by KfW programmes under different names. Promotional activities were taken over by the KfW "Energy-Efficient Construction" programme applicable for new buildings and the "Energy-Efficient Rehabilitation" programme relevant to existing buildings, and both programmes were brought in line with the latest amendment of the Energy Conservation Act (EnEV) in 2009[21]. The core structure of these programmes remained almost the same with the most apparent change being the introduction of a new standard for residential buildings, the KfW-Efficiency-House standard (KfW-Effizienzhaus).

The metric for the efficiency standard is expressed in terms of the basic standard for new buildings (called NL) as the percentage of the primary energy demand of the building for heating compared with an identical building erected to standards for new-builds, as laid down in the EnEV 2009. The current KfW programme structure is tailored around this new efficiency benchmark for buildings in Germany.

As before, KfW funds are provided as loans or as subsidies, or sometimes both. The value of the loans, subsidies and repayment levels provided by KfW is based on the value attached to energy efficiency standards, which reflect kilowatt hours consumed per square meter per annum, as shown in Table 2. The basic standard for new buildings (NL) is 100 (55-94 kWh/(m^2a). KfW financially supports new buildings that consume less energy than the 'Efficiency House' standard which consumes 85% of the baseline (NL), i.e. at least 15% better than the baseline fixed in the Energy Conservation Act (EnEV). New buildings of 'Passive House' standard consume less than 40% of the baseline of 100. Such energy-efficient homes require innovative heating technology based on renewable energy and the highest possible level of thermal insulation. They are therefore considerably more expensive than average new homes.

[21] With the latest amendent of the EnEV, energy related requirements were tightened by 30% compared with previous levels of EnEV 2007. Compliance with EnEV 2009 can be achieved for new-builds through the Reference Building Method, and for existing buildings either through the Reference Building Method or under certain conditions through the Minimum U-value Method for building components. The Reference Building Method compares the primary energy demand of the building assessed with that of a notional building with preset U-values and heating systems.

The basic standard for existing homes is legally set at 140 due to their generally lower energy performance[22]. Financial support for energy-efficient refurbishment starts to apply at 115, i.e. 15% above the baseline for new buildings. In order to meet the energy standard of a KfW 'Efficiency House', extensive investment in the renewal of heating systems, thermal wall insulation, roof and floor insulation and windows is usually required.

Table 2: Efficiency House Standard showing energy use in kWh per m² per year for houses of different energy efficiency

Primary Energy Demand [kWh/m²a][23]		
108 – 63	KfW-Efficiency-House 115	= 115% NL
94 – 55	KfW-Efficiency-House 100	= 100% NL
80 – 47	KfW-Efficiency-House 85	= 85% NL
66 – 39	KfW-Efficiency-House 70	= 70% NL
52 – 30	KfW-Efficiency-House 55	= 55% NL
38 – 22	KfW-Efficiency House 40	= 40% NL

Source: Schönborn, M. (2009) 'Germany's "pot of gold" – Paying for Retrofit', presentation at the conference *The Great British Refurb: 40% energy reduction in homes and communities by 2020 – can we do it?*, London, 8 December 2009, LSE

Note: In calculating the energy efficiency of a building, its estimated primary energy demand for heating is compared with that of a 100%NL new house with the same geometry, usable floor area and orientation as the house being assessed.

The left hand column of Table 2 shows the bands of kilowatt hours (kWh) consumed (per m^2 per annum) that are used to measure the efficiency of the house. The right hand column shows the KfW levels of efficiency, based on kWh bands that are used to assess the eligibility for different subsidies and loans. NL stands for the new-build standard with a baseline rating of 100: the *lower* the rating, the *greater* the energy efficiency. Thus 40% NL is the best rating shown in this table and 115% NL is the worst. As noted in the Glossary, a rating of 15 kWh/(m²a) or below for space heating is one definition of the 'Passive House' standard. Since the left column accounts for space heating,

[22] Compliance with this standard is checked whenever existing buildings undergo major alterations or extensions. Where an extension exceeds 50m^2 the extended part needs to meet EnEV standards for new buildings (i.e. 100% NL).

[23] For space heating, ventilation/infiltration and hot water. Numbers provided are an indication only. The primary energy demand calculated according to EnEV depends on the A/V ratio and can therefore technically range from 100% NL 40 – 120 kWh/(m^2a).

ventilation/infiltration and hot water, 'Passive Houses' can be promoted under categories 55% NL and 40% NL.

KfW does not deal directly with applications for loans; it uses the network of local commercial banks to process applications, loans and repayments and to help borrowers. KfW also runs a special modernisation programme for applicants who fail to meet the tough requirements of the government-sponsored KfW programmes. These loans are less generous because the qualifying conditions for borrowers are less stringent (KfW, 2010c).

The procedure for obtaining a KfW loan is shown in Figure 7 and may be summarised as follows:

1. The application by a 'would-be' borrower must have confirmation of the CO_2 reduction from a qualified and registered energy adviser.

2. The borrower's local bank identifies the KfW programme that applies and advises on the conditions of a loan, then submits the application to the KfW with the CO_2 certificate, on behalf of the borrower.

3. The KfW checks that the technical specifications meet the requirements of the specified programme. If this is positive, KfW sends a confirmation of the loan to the borrower's bank which becomes legally responsible for the agreed loan.

4. The borrower's bank uses the credit approval to draft a loan contract with the client.

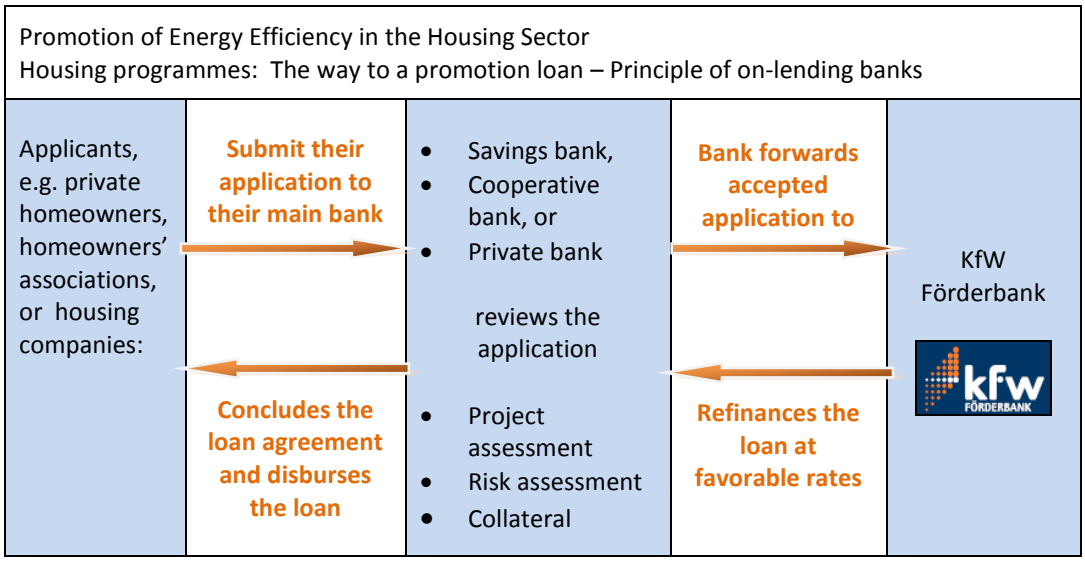
5. Once the formal contract is agreed, the borrower's bank calls down the money from the KfW.

6. Money has to be drawn down from the KfW within 12 months of the receipt of the loan approval, although an extension can be granted for up to a maximum of 24 months if necessary.

7. The sums have to be used either in full or part for the measures requested within 3 months of receipt.

Figure 7: Illustration of steps towards securing a KfW loan Promotion of Energy Efficiency in the Housing Sector

Housing programmes: The way to a promotion loan – Principle of on-lending banks



Loans are available for up to 100 per cent of the investment cost, including additional costs (e.g. architect, energy saving advice), depending on the standard of energy efficiency to be achieved. The 'whole house' or 'Efficiency House' approach is funded more generously than individual measures or a combination of individual measures:

- Maximum 75,000 Euros per housing unit for Efficiency House standards (a comprehensive approach). A bonus can be paid after completion of the measures, the highest bonus for homes that achieve KfW-Efficiency-House 85 (see Table 2).
- Maximum 50,000 Euro per housing unit for individual or combined measures.

A combination of KfW loans and other funding in the shape of loans, grants or subsidies is allowed as long as the total amount does not exceed the total expenditure. Loans last for 10 – 30 years. Interest rates are variable, but in general the higher the CO_2 improvements, the lower is the interest rate. In September 2011, for the Efficiency House standard (KfW Programme 151 – Energy-Efficient Refurbishment of the whole house) and for individual and combined measures (KfW Programme 152) the interest rate was 1.00% fixed for 10 years. Access to loans is by owner occupiers, landlords and new buyers of

newly refurbished residential units including individuals, housing companies, housing co-operatives, municipalities, district bodies, community groups and other public or non-profit bodies.

For non-commercial, permanently occupied buildings erected before 1995 (WSchVO95), subsidies are available for the refurbishment to 'Efficiency House' standards and also for individual measures for a combination of measures. Subsidies cover a percentage of the investments for investments over €300: the higher the energy efficiency to be achieved, the higher the subsidy, as shown in Table 3, with 55 being the lowest and 115 the highest qualifying for subsidy. Subsidies are only available to owners of 1-2 family homes (max. 2 housing units), to purchasers of newly refurbished 1-2 family units, and to owner-occupied co-operatives. The subsidies are also available for purchases of a refurbished dwelling providing the grant was not initially allowed to the home-builder.

Efficiency House standard	Proportion of investment costs that can be covered by KfW subsidy (%)	Maximum subsidy per housing unit (€)
115	7.5%	€5,625
100	10%	€7,500
85	12.5%	€9,375
70	15%	€11,250
55	17.5%	€13,125
Individual/combined measures	5%	€2,500

Table 3: KfW subsidies for measures reaching different energy efficiency standards

Applications for subsidies, which are available independently of an applicant's income, are made directly to KfW, unlike loans which come via credit institutions. 'Efficiency House' subsidies require a certificate from an approved energy adviser, and, in order to be eligible for subsidies, the work has to be undertaken by paid workers and to meet the technical requirements of the programme. KfW subsidies cannot be combined with loan programmes subsidised by federal or regional governments. They can be combined with subsidies from other bodies as long as the total subsidies and funding from other sources do not exceed 10% of the eligible cost.

Houses in conservation areas or that are protected (listed) can be exempted from some technical requirements. An application to KfW has to include exemption approved by the German Energy Agency (DENA), and a statement from the conservation authority confirming the conditions attached to the refurbishment. The proposed measures must be completed within 36 months of the subsidy approval.

KfW loans are also available for energy-efficient refurbishment by municipalities, when they are restricted to local government and their legally related organisations and community associations, and by non-profit organisations, including churches. Under both programmes refurbishments are available to the 'Efficiency House' standard and for individual and combined measures.

VI.4 National support for KfW's loans

Figure 8 (Schönborn, 2008) explains how the national budget in 2007 supported the KfW programmes for energy-efficient construction and rehabilitation.

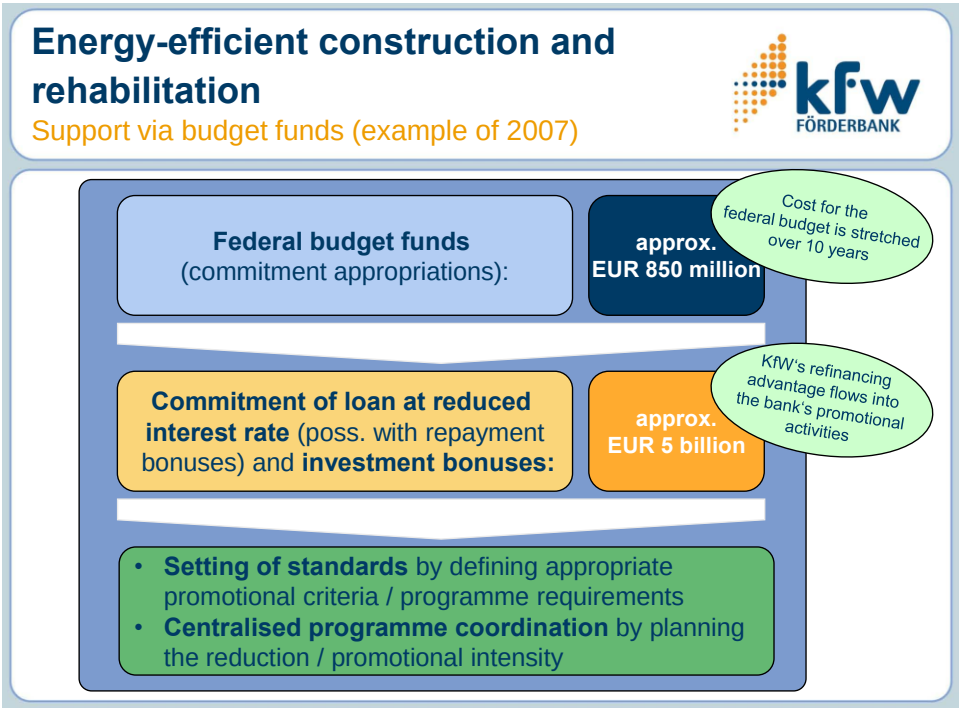


Figure 8: Support of KfW programmes via federal budget. © KfW 2008

Although loans worth over €5bn were granted for energy efficiency investments the impact on the national budget remained limited as KfW raises funds on the financial market and federal money is only used as subsidy for reduced interest rates. The loan to the homeowner comes from a normal bank, but is re-financed by KfW on the capital markets, with the German Federal Government providing a subsidy to keep the interest rate low.

VII Germany's climate policy achievements

VII.1 Renewable energy, CO_2 and the economy

According to a recent analysis, Germany ranks first among all G20 countries for its energy efficiency and wider measures to combat climate change, and second for its renewable energy and feed-in tariff programmes (Höhne et al., 2009).

Renewable energy

Its main achievements in renewable energy development since 2000 include the following:

- Renewable energy use has more than doubled from 4 to 10 percent;
- Renewable electricity generation has risen from 6 to 15 percent;
- Renewable heating has doubled from 4 to 8 percent;
- These trends have put Germany on course to reach a renewable share of final energy consumption of 20 percent in 2020 (2 percent above Germany's EU target), 32 percent in 2030, and 54 percent in 2050.
- Renewable energy is projected to meet 35 percent of total electricity generation in 2020 (BMU, 2010a)

CO_2 Impacts

The use of renewable energy in electricity, heating, and transport has greatly reduced CO_2 emissions. They fell 21 percent from the 1990 base of 948 million tons to 748 million tons in 2008. Total CO_2 saved in 2009 through renewable energy alone was 109 million tons, a decline of 12 percent (Böhme et al., 2009). By far the biggest savings will be in the electricity sector (320 million tons); heating will save 80 million tons; and transport an additional 48 million tons.

Economic and employment impacts

Energy saving and renewable energy have both underpinned Germany's strong recovery since the financial crisis of 2008. The job impacts of the building refurbishment programme are significant, around 240,000 new jobs a year since 2006. At the same time, renewable energy is a major growth sector in Germany. Renewable energy industries have generated increasing numbers of new jobs each year, from 160,000 in 2004 to over 300,000 in 2009, two-thirds of which are estimated to have resulted from adoption of the Renewable Energy Sources Act (EEG). Renewable energy exports have also risen steeply, making renewable energy a major contributor to Germany's strong macroeconomic performance (DENA, 2007).

While other parts of the economy shrank during the downturn, renewable energy manufacturing, export, and production continued to grow. Between 2003 and 2009, total turnover in renewable energy production more than tripled from €10 billion to €33 billion, following €18 billion investment in production plants and €16 billion in the manufacturing and delivery process itself (BMU, 2010a).

The German government estimates that 400,000 further jobs in renewable industries will emerge by 2020, with continuing expansion to 2030 and onwards (BMU, 2007). The rate of job expansion will obviously depend on energy prices, export demand, and government policy, but the upward trend is currently extremely strong (Kratzat and Lehr, 2007).

Germany's global engineering and manufacturing reputation make it an attractive production centre for renewable energy technologies, while its energy-saving products and systems are being exported across the EU.

VII.2 Energy saving and energy-efficient buildings, 2006-2009

KfW's loan and subsidy programmes between 2006 and 2009 were dedicated two thirds to existing homes and one third to new. The outputs for the 4-year period include:

- the energy-saving refurbishment of 1 million existing homes and the addition of around 400,000 new highly efficient homes;
- direct employment of around 894,000 jobs in the building and building supply related industries[24]. The jobs included lasted for at least one year and many become long-term jobs;
- around €27 billion in loans and grants;
- and more than €54 billion total investment;

€2 billion public investment generates investment loans of €9 billion plus the personal investment households make. This created €19 billion investments in 2009. Low-interest loans to cover part of the cost, involving modest public subsidy has levered in high major additional investment. €1 of budget subsidy results in €5 of loans; and €1 subsidy triggers a total investment of €9 - €10 (Hertrampf, 2010).

There are now 8,000 Efficiency House model retrofits of the highest standard, using 30% less energy than the ambitious Energy Conservation Act (EnEV) standard (2007). There are also 32,000 passive houses (Kwapich, 2010a).

The demand for KfW subsidy and loan programmes grew fast from 2001. In 2009 it took a new leap forward for several reasons:

[24] Note that this is direct job creation only. No attempt has been made here to calculate the net employment, or other macroeconomic, effects of the KfW programmes

- loans at very low interest rates (1%) accelerated take-up.
- The severe winter of 2006/07 led to big increases in fossil fuel prices and demand for insulation and energy saving.
- The revised Energy Conservation Act (EnEV 2009) raised the requirements for both new and existing buildings.
- Successful information dissemination through DENA's information campaigns, the work of local energy agencies like ProKlima, and special projects and programmes under the national 'Climate Protection Initiative' promoted wide acceptance.

On the other hand the increase in VAT in 2007, and again recently, has raised the cost of building materials and labour, making investment in retrofit more expensive. Table 4 shows the growth of KfW programmes since 2006.

Table 4: Take-up of KfW programmes – energy-efficient new building and refurbishments, 2006-2009

Year	2006	2007	2008	2009	Total since 2006
Loan commitments (in €m)	6,998	4,782	6,343	8,863[a]	26,986
Housing units (in 1,000s)	328	204	280	617	1,430
CO_2 reduction (in 1,000 tons p.a.)	1,038	568	837	1,452	3,897
Jobs (in 1,000s)[b]	217	177	208	292	894
Investments (in €m)	11,845	10,682	13,248	18,335[a]	54,110
[a] €2bn quals €3,094 million for energy-efficient new building plus €5,769 million for energy-efficient refurbishment. . [b]Jobs lasting for at least one year					

Source: (Schönborn, 2010)

VII.3 Reasons for success

Several features of Germany's approach to stimulating a robust "retrofit economy" underpin its successes thus far:

- The three pillars of the German approach—a clear legal framework; strong subsidy and loan programmes; and promotional information, advice, and support—are driving fundamental changes in Germany which both international and national bodies agree are vital to efforts to combat global climate change and secure our future energy needs (Menzer, 2010).

- The links between German legislation/regulation and subsidies change energy consumption behaviour and drive strong take-up. The level of subsidy and size of loans grow with the level of ambition, as higher energy savings require more public financial support (KfW, 2010c). The terms and conditions of loans and subsidies make the benefits and costs of different measures transparent (KfW, 2010c).

- The combination of generous subsidies and low-interest loans with highly ambitious standards and a "whole house" approach generates an investment of around €36,000 per home in energy efficiency and renewable technology.

- Germany has taken a comprehensive approach to retrofitting the built environment. Almost all domestic buildings, small or large, landlord or tenant and many publicly owned buildings are eligible for subsidy for retrofit. The only exclusions are applicants who are not credit-worthy or who propose over costly measures for the eligible finance. There is no legal limit to eligibility and there is enough flexibility to apply particular subsidy programmes to exceptional cases (KfW, 2010c). The aim is to use public policy to refurbish the entire housing stock and all public buildings in Germany by 2030.

- Energy savings targets are aggressive with respect to both new and existing homes and inspire innovation in energy technologies and building practices. The newest "Passive House" standard achieves energy usage 60 percent below the baseline for new homes, while the latest prototypes achieve 85 percent savings.

- Channelling retrofit subsidies through a publicly supported investment bank (KfW) provides government with a funding investment tool that is immensely powerful throughout all regions of Germany. This gives weight to the programme, increases efficiency and leverage, and inspires private-sector confidence. KfW does not have to promote itself, and instead relies on local banks to transact business on its behalf (KfW, 2010c).

- A step-by-step approach using pilot projects develops standards and promotes programmes in specific areas. A central organisation like DENA can thus develop and trial individual measures, which it then fits within the subsidy programmes for KfW. It uses its experimental approach to feed into strengthening the legal framework (Kwapich, 2010c). Pilot projects persuade housing companies to adopt and promote energy saving but they also persuade the government of what works (Timm, 2010).

- DENA's publicity and marketing activities work because of DENA's access to experts architects (engineers, planners, researchers), who in turn influence clients. Their guidance and expertise reach a very large audience via local agencies (Kwapich, 2010c).

These factors appear to be the principal reasons why Germany's approach clearly works, judging by the rate of adoption. Bringing together some of the data already presented, as of 2010, 9 million pre-1979 housing units had been rehabilitated to high energy-efficiency standards (Schüring, 2010). Over 2006-09 KfW programmes retrofitted 1 million existing homes with energy-efficient products, and approximately 400,000 highly energy-efficient new homes were built, generating approximately a quarter of a million jobs per year (894,000 in total over 2006-2009), largely in the construction and supply chain (Power and Zulauf, 2011). Energy efficiency in new buildings has doubled over 2002 – 2009, reducing calculated energy use from 120 kWh/(m^2a) to 60 kWh/(m^2a), while renovation has reduced it to approximately 80 kWh/(m^2a) in existing buildings (Höhne et al., 2009). (Hertrampf, 2010) estimated that every €1 of subsidy has leveraged €9 in loans and private investment, while (Höhne et al., 2009) identify a leverage ratio of 1:10 for the KfW programmes and 1:12.5 for the Market Incentive Programme (MAP). KfW energy-saving programmes between 2006-2009 have saved heating costs of €1bn per year, resulting in savings of almost 4MtCO_2 per year (Schönborn, 2010). CO_2 savings through the support programmes (low-interest loans and investment subsidies through KfW and MAP) are estimated at around 1.2MtCO_2 per year. Over the lifetime of the investments, the various measures are estimated to have led to long-term savings of around 72MtCO_2 (Höhne et al., 2009).

The German approach is not without its limitations, which should inform the adoption of analogous policies and practices elsewhere:

- The German legal framework for energy-efficient buildings (and for renewable energy technologies) is complex, requiring considerable support and strong enforcement (Höhne et al., 2009). It is hard to transpose literally to other countries.

- The range of subsidy programmes at federal, regional, and local levels, each requiring explanation and publicity, is also complex. Few grasp the whole national picture because of Germany's highly decentralized system and regional variations (Kwapich, 2010b).

- The German energy-saving programme remains a work in progress and there are frequent new developments that require energy advisers to translate information for public understanding and action. DENA's aim is to summarize, simplify, and standardize this process (Kwapich, 2010b).

- Regional governments are responsible for historic-building conservation but the process of protection is the responsibility of municipalities, so differences arise in the interpretation of the law when applying this to energy efficiency measures.

- For landlords, tenancy laws, legal standards, rent regulation and loan repayments all complicate decisions about investment in energy saving. Modernisation is a valid criterion for rent increases, but rent increases cannot by law exceed 11% a

year. This limits what a landlord can invest in energy saving. Tenants do often favour energy saving modernisation and are willing to accept some increase in their rents but want tighter regulation of rent increases (DMB, 2010b). Any public subsidies for modernisation have to be deducted from the rent increase.

- Renting is so common that there is competition for potential tenants in some parts of Germany. This drives landlords to make the best offer possible, including energy efficiency gains. But low-income households will often choose the lowest rents without prioritising energy bills and therefore exert little pressure on landlords to improve energy performance (KfW, 2010c).

VII.4 Outstanding challenges

Of Germany's 39 million homes, 75% (29 million) were constructed before 1979 prior to higher energy standards being introduced. So far 9 million units have been rehabilitated to high energy efficiency standards. This leaves 70% of the existing pre-1979 stock performing below the legal requirement for existing buildings.

Refurbishment take-up is still slower than needed. With 20 million units still to be tackled, at the present rate of refurbishment, it will take at least 80 years to refurbish the remaining stock. Meanwhile replacement of building parts, the requirements of constant renewal, and demand for ever higher standards will accelerate (Kwapich, 2009). As standards of efficiency rise, retrofitting will continue as a priority. The current annual refurbishment rate of 200,000 buildings (around 400,000 homes) needs to double to 400,000 per year (around 800,000 homes), to complete this refurbishment process in 20 years (Kwapich, 2010b, Schüring, 2010). Box 3 shows the main barriers which could be overcome, given the infrastructure in place and the steady pace of change.

Box 3: Barriers to progress

- **Lack of clarity on standards:** Energy Performance Certificates introduced EU-wide are far from universal. Only one third of private landlords have them (Kwapich, 2010c). Although a high proportion of individual owners who had received professional energy advice later implemented energy efficiency measures, far more outreach is necessary.
- **Complexity of the refurbishment process and lack of trust in experts, builders and results**: Networks of architects, engineers and other building experts should work together to overcome the complexities of advice, subsidies and standards to avoid each undermining the other. This problem is exacerbated by there being two sets of advisers: the Energy Performance Certificate Advisers and the on-site energy advisers. This sometimes leads to duplication and confusion.
- **Need for advances and training in complex building refurbishment issues such as air circulation, damp etc**.: some architects undermine the level of work undertaken, relying on common myths e.g. external walls need to 'breathe' and should not be insulated, students of architecture pick up and spread these myths at universities (Timm, 2010).
- **Financing refurbishment:** Upfront investment in high energy efficiency leads to positive paybacks later. For example, the thicker the insulation, the more it costs, e.g. the optimal insulation thickness for external walls is 20 cm, the payback may take 20 years.
- **Need for higher standards:** The insulation standards under the current building codes will rise , and attainment of them will be increased, when the Energy Conservation Act (EnEV) raises the requirements and favourable loans

VII.5 Looking Ahead

In 2009, KfW received over €2 billion from the government, all of which was dispensed. In 2010 only €1.25 billion was forthcoming. To achieve the climate protection aims, finance has to double at least. Yet future demand is uncertain. If oil and gas prices decline even the strongest subsidies will be inadequate. If oil and gas prices rise, as is predicted, energy-efficient refurbishment will carry on, even if government funding is reduced and taxes such as VAT rise. There are no reliable forecasts based on these uncertainties (energy prices, subsidies and VAT rates) (KfW, 2010c). The German government is nervous about raising standards even further, as implementing them would be expensive and may offer diminishing returns (Menzer, 2010). It would also be harder to enforce even higher standards than current ones (Hertrampf, 2010). The most likely way forward

is to keep pushing in the same direction and allow the pressures on energy supply to push too.

In rich countries like Germany, transition to a low- (near zero-) carbon economy is extremely challenging, even though it is widely accepted as necessary. For this reason such a comprehensive and thorough approach to energy saving seems both necessary and a cost-effective way of achieving carbon emission reduction targets. The German economy gains jobs and small businesses (builders, suppliers, professional and technical firms) expand, new skills, and innovative approaches, and public engagement gathers momentum. And the 'energy crunch' which all European countries seem likely to face in the coming decade becomes more real to people in their daily lives, thus enhancing public support for tackling climate change.

VIII Lessons from the KfW experience for the UK

VIII.1 The Green Deal, Energy Company Obligation and Green Investment Bank

Through provisions in the Energy Act 2011 a new scheme for the energy efficiency refurbishment of buildings will be implemented in the UK in 2012. While at the time of writing the final details of the scheme were still being consulted on, the broad outlines are clear and may be summarised as follows.

The scheme will provide opportunities for households (and businesses, but the focus here is on households) to make energy efficiency improvements in two ways. For those measures (e.g. cavity wall or loft insulation) which are expected to pay for themselves over the lifetime of the measure installed, finance for the measure will be available through the Green Deal. For those more expensive measures unlikely to pay for themselves in this way (e.g. solid wall insulation), support may be available through the Energy Company Obligation (ECO).

The Green Deal is a package that combines accredited energy advice and installation with the provision of finance. The major financial innovation in the Green Deal is that the finance for the energy efficiency measures is attached to the property and it is recouped through extra charges on the energy bill of the house concerned. Responsibility for the repayments therefore rests with the bill-payer in the property, who may have moved into it after the measures were installed, rather than the owner or bill-payer at the time of installation (as with normal home loans), who will have no further liability if they sell or move out of the property. The Green Deal finance is thus secured through the payment of energy bills, rather than against ownership of the property. It is hoped that being secured against energy bill payments will reduce the cost of Green Deal finance as against an unsecured loan (though it may not do so compared with mortgage finance that is secured against the property). For measures to be eligible for Green Deal finance, as noted above, the expected energy and associated cost savings, as assessed by an

accredited adviser, must be greater than the repayment charge on the energy bill, and the total repayment period must be lower than the expected lifetime of the measure.

These conditions are called the Green Deal 'Golden Rule', and they will determine the level of the maximum possible loan. This seems very unlikely to be above £10,000. In 2009 the UK Green Building Council published what was then one of the most comprehensive analyses of PAYS (Pay-As-You-Save) schemes of this kind, in which it calculated: "The upfront costs supported by PAYS is up to £10,000 and the typical net savings (after the annual PAYS Charge obligation has been met) would be of the order of £50 to £200 per year (based on gas heating) depending on the extent of the low-energy upgrade undertaken. The typical PAYS Charge period is 25 years." (UKGBC, 2009). On a £10,000 loan and a 25-year payback, the Golden Rule would require gross savings of at least £400 per year. Only very energy-inefficient households using a great deal of energy could expect to save that much for that level of investment. The Existing Homes Alliance (EHA) estimated in 2010 that a 'whole-house' package of energy-saving measures, which would be required to save up to 70% of energy and carbon emissions, could cost £12,200-39,400 for a typical house and £18,300-54,100 for a house with solid walls (EHA, 2010). Again, a combination of very high energy use and very long payback periods (and therefore a long assumed life of installed measures) would be required for loans at this level to satisfy the Golden Rule. The provisions under ECO are likely to be critical if investments at this level are to be widely taken up.

There is no provision at present for any government subsidy to be provided through the Green Deal: only those measures will be installed that are expected to recoup their full market costs of finance and installation, the hope being that the Green Deal financing and repayment provisions will make this market mechanism sufficiently attractive to see a step change in energy efficiency installations.

The Green Deal legislation also provides that landlords will need to respond positively to tenants' 'reasonable' requests for energy efficiency measures, where these will be installed at no cost to landlords (the cost being repaid through tenants' energy bills). Local authorities will acquire powers to require landlords with the least energy-efficient properties (F- and G-rated on their Energy Performance Certificate [EPC]) to improve them.

'Vulnerable' households (those containing children, pensioners or the disabled or sick) with low incomes may be under-heating their homes such that even less expensive energy efficiency measures may lead to their home becoming warmer rather than saving them money. Moreover, as noted above, some energy efficiency measures will be too expensive to comply with the Golden Rule of the Green Deal. Both these households and these measures will be eligible for extra financial support, to be provided by the energy suppliers under the Energy Company Obligation (ECO). This will build on the experience of the current energy supplier obligations, the Carbon Emissions Reduction Target (CERT) and Community Energy Saving Programme (CESP), but the details of how this will operate

are still unclear and will be consulted on through late 2011 and 2012. ECO is due to start in 2013.

While the Green Deal and ECO are intended by the UK Government to be the main policy mechanisms for stimulating investment in household energy efficiency, it may be that a role will also be played by the Green Investment Bank (GIB). The intention to set up GIB was formally announced in Budget 2011, and while it is intended that its main initial areas of investment focus will be offshore wind, waste management and non-household energy efficiency, a recent update of Government thinking in this area has said that initial GIB analysis will "include consideration of the potential and necessity for the GIB to support the financing of investment in domestic energy efficiency during the first stages of Green Deal delivery" (BIS, 2011).

GIB will have initial capitalisation from the Government of £3 billion, which will start being disbursed from April 2012. Once State Aid agreement has been received from the European Commission, GIB will be established as an enduring institution at arms length from government. GIB will be able to borrow from 2015-16 provided that government debt as a percentage of GDP has started falling by then.

This is the current context in the UK in which any learning from the operations of KfW in German would need to be applied.

VIII.2 Comparing the housing and energy and energy efficiency contexts in Germany and the UK

The detailed description above of the history and current energy efficiency operations of KfW should make it obvious that the KfW experience could not be transferred as a whole to another country. Any lessons from KfW would need to be applied appropriately in the undoubtedly very different context of the other country under consideration, in this case the UK. This section compares some of the main features of the housing and energy efficiency contexts of Germany and the UK.

Of the 22 million homes in England in 2006, some 15 million (70%) were owner-occupied, while 2.6 million (12%) were privately rented. Overall, 2.1 million (9%) homes were rented from local authorities and 1.8 million (8%) from Registered Social Landlords (RSLs) (CLG, 2008).

Current energy efficiency programmes in England (often with comparable programmes in other parts of the UK) funded or mandated (through energy suppliers) by the UK Government are the Carbon Emissions Reduction Target (CERT), the Community Energy Saving Programme (CESP) and Warm Front. CERT and CESP are funded by energy suppliers, so there are no precise details of their associated expenditures. However, the Government has estimated that CERT over 2008-12 will cost £5.5 billion (DECC, 2011a), while CESP, which began in September 2009, was expected to cost £350 million (DECC, 2011b). The budget for Warm Front, which offers maximum grants of £3,500 (£6,000 when oil-fired central heating is recommended for homes off the gas grid) to eligible households (those on certain state benefits), and is funded from taxation, was £959

million for 2008-11 (NAO, 2009), and was then reduced in the 2010 Comprehensive Spending Review to £110 million over 2011/12 and then to £100 million in 2012/13 (Welling, 2010). All those programmes are due to be rolled into ECO from 2013.

Box 4 contrasts some relevant aspects of Germany's experience and circumstances with those of the UK.

To date there is no doubt that Germany's more generous *and* more exacting approach to energy efficiency in homes has led to much higher take-up of energy efficiency measures, and associated saving of energy and reduction in carbon emissions, than seen in the UK so far. However, both countries have the same long-term CO_2 reduction targets (80% from 1990 levels by 2050). There is little doubt that both countries will have to increase their rate of adoption of energy efficiency measures, but the UK has to do so from a much lower base and so the rate of increase will have to be substantially greater.

Box 4: Differences between Germany and the UK	
Germany has a carbon reduction target of 80% by 2050.	The UK has pioneered statutory carbon budgets towards a legally binding carbon reduction target of 80% by 2050 with the Climate Change Act.
Germany's owner-occupied sector is just over 40%. The largest sector in Germany is private renting at 60%.	Private renting is relatively small in the UK but growing – from 8% (1980) to 15% (2009). Owner occupation (70%) requires different incentives to encourage investments in energy-saving refurbishment.
Germany's legal, funding and information 'pillars' are well established and far reaching.	The 'whole house approach', 'passive house' standards, feed-in tariff, EPCs are in the early stages of development in the UK.
Germany has pioneered the 'Passive House', a model using negligible amounts of energy (and mostly renewable sources), for both new build and retrofit. It has also pioneered legal and funding frameworks for renewable energy and energy saving. It outperforms all other European countries in these developments.	The UK adopted a Code for Sustainable Homes, which at its highest levels emulates some features of the German Passive House standard.
In Germany, the main target group for energy saving is private housing companies/**landlords**; but also public bodies e.g. schools.	In the UK the main target will be **individual home owners**, but social landlords have pioneered new approaches and are sometimes able to target the poorest. Private landlords will be legally obliged to meet minimum energy performance criteria.
Germany's financial support system offers loans and subsidies (up to 20% of investment costs for the most energy-efficient refurbishments) - a major shift away from tax incentives (in the 1970s - 1990s). **Loans**	UK support through the Green Deal shifts support from grants to loans for investment in energy efficiency upgrading. Grants may still be available through ECO. The feed-in tariff for renewable electricity

encourage energy saving because recipients have to pay back so they calculate savings more carefully. Feed-in tariff for renewables shrinking but still very significant.	introduced in 2010 has proved very popular with rapid take up. Renewable heat incentive introduced in 2011.
Interest rates on the loans given through KfW are subsidised through the government and are currently around 1%.	Interest rates on Green Deal loans will be unsubsidised (unless ECO offers special rates), and are expected to be around 7%.
Eligibility for and the levels of support provided by German loan and subsidy programmes are determined by building standards and requirements for energy efficiency. KfW funding requires specified technical standards, but any measures can be used to achieve the required standards.	Building standards, legislation and financial support programmes in the UK increasingly draw on German experience. Installers working through the Green Deal will require formal accreditation. New houses in 2016 will need to be 'Zero Carbon'.
The KfW approach generates an investment of around €36,000 per home in energy efficiency and renewable technology.	The size of Green Deal loans will depend on the measures satisfying the 'Golden Rule, but seem unlikely to exceed £10,000.
Most German homes are flats. Heat requirements and the type of insulation technologies, materials and methods are different.	Most UK housing stock is in single family homes where insulation is more crucial. Flats make up 15% of the stock, are easier to insulate and less energy consuming.
Germany has very few *large energy companies* operating nation-wide but many local and regional public supply companies (Stadtwerke) providing electricity. Many small 'green' renewable energy supply companies were set up since 2000 to generate and sell 100% green, i.e. renewable energy.	In the UK, only three small companies offer tariffs with 100% renewable electricity (Ecotricity, Good Energy and Green Energy UK), but the 'big six' suppliers also have 'green tariffs', with different criteria.
KfW, the German national investment bank, is the major conduit for	In the UK major funding for carbon reduction (energy saving and

government subsidies and loans – operating on a very large scale.	renewables investment) currently comes through a legally binding 'supplier obligation' on energy companies. ECO will continue this, while the Green Deal and GIB provide quite different routes for energy efficiency provision in the future.
In 2009 KfW lent €5.8 billion for refurbishment of existing buildings, triggering perhaps double that investment by private households	The total GIB capitalisation to 2015 will be £3 billion. Loans for home energy efficiency are likely to be a small proportion, if any, of its loan book.
In Germany, there is a *legal limit on annual rent increases* (up to 11% per year maximum) even after the refurbishment. This restricts how much landlords invest and how much tenants will contribute.	In the UK *rent limits* only apply to social housing. Private landlords have little incentive to invest in energy saving since usually tenants benefit, and rents would become uncompetitive. The Green Deal has special provisions for landlords (as noted above).
Germany's programmes of loans and subsidies are offered by the KfW Bank but also by regional and local federal governments. The complex financial supports are cash limited as a total. A lay person has to rely on expert advisers to help secure funding. On-site energy advice is subsidised in Germany, to help home owners, but the sheer volume of decisions to take on all the elements of refurbishments is off-putting.	The Green Deal package will rely on accredited energy advisers and accredited installers working with or through a Green deal provider, which arranges the finance. It remains to be seen to what extent these arrangements simplify the 'customer experience' of installing energy efficiency measures in houses, the complexities and uncertainties of which have to date been a major barrier to take up .
Housing companies and landlords are the largest housing investors in Germany. They have their own experts to call upon and a lot more experience with planning and delivery of refurbishments than individual owners, therefore they can do more.	Energy advice comes directly from energy suppliers or through the Energy Saving Trust. Some radical energy-saving initiatives are being delivered by a few social landlords and a growing (but still small) number of individual owners in the UK.
Germany has developed comprehensive information programmes	In the UK, large-scale awareness programmes have been effective when

(face-to-face events and online) for the general public, educational institutions, local/public authorities and private companies. These both raise awareness and offer free energy assessments, products or vouchers, and recommend approved experts and programmes. Germany's efforts to target fuel poverty are much less than the UK. Poor households can receive a payment supplement to help with extra energy costs during extreme weather.	coupled with incentives, but overall take-up nationally remains low. Fuel poverty is a significant social concern. 'Warm Front' is a government-funded programme to upgrade the energy efficiency of households receiving certain state benefits, which will be discontinued when ECO starts. All pensioners qualify for annual Winter Fuel Payments, and Cold Weather Payments are also paid to poorer pensioner households during periods of prolonged cold weather.

As already noted, Germany's approaches that have given it leadership in reducing the carbon footprint of its built environment cannot be transposed wholesale elsewhere, but holds a range of more general lessons for countries like the UK which are at an earlier stage of energy efficiency improvement.

Lesson 1: Germany has adopted a 'three-pillar' approach that integrates energy efficiency provisions into a clear framework of regulation, information and support for renewables. This has served it well, creating a strong, enforceable legal standard to underpin change and generating a clear, consistent message about the direction and required radical nature of change.

Lesson 2: The German approach seeks to provide enough incentives to draw people in, but through repayable loans on favourable terms, or performance-linked investment subsidies, rather than unconditional subsidies or tax concessions, as a more reliable and sustainable funding mechanism. The UK too is moving towards loans, but it remains to be seen whether the proposed ECO is able to make up for the complete lack of subsidy in the Green Deal to incentivise the take up of more expensive energy efficiency measures, or even whether the Green Deal package is sufficiently financially attractive to overcome the well documented barriers to take up of home energy efficiency measures of any kind.

Lesson 3: The German schemes provide qualified expert advice and installation so that appropriate work is carried out to a high standard, resulting in the promised energy gains being achieved and a positive customer experience. One result has been that over time the German construction industry has acquired great expertise in this area. The UK has less experience and expertise, although the years of Warm Front and CERT (and its predecessor supplier programmes) have meant that it is now much better off in this respect than it was. The accreditation mechanism under the Green Deal for energy advisers and energy efficiency installers will be crucial to assuring its widespread uptake.

Lesson 4: Linking renewable energy generation to energy-saving measures by requiring investments in energy efficiency *before* subsidies for renewable energy are paid (e.g. through the feed-in tariff) both increases the proportionate contribution renewable energy can make to meeting overall demand, saves the householder money, makes a bigger contribution to the wider goal of climate protection, and provides a more coherent overall message to the public about the need to reduce CO_2 emissions. The UK has effectively adopted feed-in tariffs for renewable electricity and heat, but has yet to articulate in legislation the prior requirement to carry out energy efficiency measures to be eligible for these.

Lesson 5: It is better to adopt a 'whole house approach' to energy saving, even if measures are adopted piecemeal, and high energy efficiency measures only implemented bit by bit as people work on different parts of their houses. This enables people to get an overall view of the task ahead and to prioritise and plan for ambitious levels of energy saving. It also makes it easier for energy suppliers and builders to plan for the future, and more likely that ultimately home energy use will decarbonise to the required extent.

Lesson 6: New ideas, experimentation and innovation should be developed and trialled through pilots and models, to build awareness and familiarity for new approaches to energy efficiency. Like Germany, the UK has a generally good record in such experimentation and innovation. It has so far been less successful in terms of building the necessary expertise, institutions and supply chains required to take successful pilots and models to scale.

Lesson 7: Ambitious retrofit measures should be applied to public buildings as well as private homes, to provide conspicuous examples to the public. This is particularly the case in schools, nurseries and children's centres, where educational benefits, as well as more general awareness raising, can be secured.

Ultimately there is no getting away from the fact that conserving attitudes and behaviour towards energy use, and awareness of the need to reduce greenhouse gas emissions, are going to be required if the necessary step changes in home energy efficiency are to be achieved. In this respect it is hard to avoid the conclusion that the German public is significantly ahead of the UK.

There has so far been widespread public support in Germany of the government's energy saving and green initiatives (Stigson et al., 2009, Weidner and Mez, 2008). Consumers have called for and cooperated in measures promoting sustainability since the 1970s and have been increasingly active in pushing the government towards a lower-carbon society. The demand for even better information than currently on the energy performance of products is growing as people want to make informed choices about purchases (Stigson et al., 2009).

The decisive recent rejection in Germany of a new generation of nuclear power stations has clearly expressed the public desire for Germany's energy future to be based, on grounds both of low environmental impact and energy security, on the highly efficient use of renewable energy. There seems to be a more general recognition than in the UK that, while in the short term at least, renewable energy and its stimulation may be more expensive per unit than high-carbon and nuclear alternatives, combining this with an aggressive energy efficiency programme can keep overall energy costs within acceptable limits. Partly as a result, and in contrast to many other countries, climate initiatives are not generally seen as an economic burden, and the government and the lobby to reduce carbon emissions have focused their publicity on the net positive benefits of the climate programme for the country as a whole. The creation of thousands of new jobs in green technology and renewable energy sectors, and decreasing dependency on energy imports, has further contributed to a positive public attitude towards government initiatives. The shift towards cleaner technologies and a green economy is widely seen to create economic winners rather than losers (Weidner and Mez, 2008).

Similar messages have been coming from the UK Government at least since the publication of the *Low Carbon Transition Plan* in July 2009 (HMG, 2009), although climate policy as such goes back to 1994 (HMG, 1994) and has been regularly updated since (DETR, 2000, HMG, 2006). But the results of this policy, in terms of actual carbon

emissions reductions, are widely acknowledged to have been disappointing (Helm, 2008), and certainly a 'step change' is required if the UK Government's 2050 GHG emissions target, and interim carbon budgets, are to be met (CCC, 2009). Increasing household energy efficiency has a crucial role to play in achieving that step change. The Green Deal, Energy Company Obligation (ECO) and the Green Investment Bank are all welcome new policies in the right direction. But on the basis of the KfW experience, they do not go far enough on any of the key dimensions: the regulatory framework, the level of the financial incentive or the clarity of the message about integrating home energy efficiency and microgeneration using renewables for both electricity and heat. More will need to be done. In considering this, much can be learnt from what the KfW bank has achieved, how it has achieved it, and the overall policy framework that has supported these achievements.

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